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The 125th Fourth of July.

It so happens that this number of the "American Machinist" is dated in America on the 125th anniversary of American independence, and our readers are likely to join all other good citizens in some observance of the day. We have made great progress in this century and a quarter—greater than could at its beginning have been imagined; but at the same time we have learned also what Thomas Jefferson seems to have been almost the only prominent man of that time to foresee—*i. e.*, that not all the great problems that confront humanity are solved by the simple adoption of a representative government. Of late these problems seem to have presented themselves in rather rapid succession and we hope most of our readers have that form of patriotism which leads a man to really study civic problems and devote some time and energy to the betterment of public affairs rather than that form which is satisfied to merely shout, or brag, or declaim about "the flag." We are by no means pessimistic about the outcome, but believe that things will work out for the ultimate good of the greatest number. Only they will be worked out by the thinkers and the workers, not by those who neither think nor work, but only shout, and boast and shirk, or always take what they believe to be the popular side of every public question.

We hope every machinist will secure a firm grasp of the great principles contended for by our forefathers and realize the fact that by declaring all men to be created equal they did not mean (as some foolish people have declared they did mean) that all men are born of precisely the same weight and with the same amount of physical and brain power or potentiality, but only that they are born with precisely equal political rights; not that the world owes every man a living, but that it does owe every man an exactly equal chance to make a decent living for himself and those dependent upon him—each according to his ability and industry. This is the great underlying principle of the acts which we celebrate on our national holiday, and machinists whose work, probably more than that of any other class of men, produces the most profound and far-reaching effects upon social life and upon our manner of living should, it seems to us, be especially interested in those matters of public concern the study of which tends toward good citizenship and the advancement of all worthy interests.

A Change in Personnel.

That technical education is beginning to produce results which can be expressed in figures, close observers are well aware. It is not so long ago that there was a distinct and widely spread prejudice in machine shops against the technical graduate. Many such graduates in those days considered it to their advantage to keep the fact of their being graduates in the background, or even, in some cases, to keep others in entire ignorance of it until they had found a footing and established themselves by the merit of their work. Remnants of this prejudice are still to be found, but the graduate has established himself too firmly and in too many places for it to be any longer a matter of moment to him.

The change was well illustrated at the recent Milwaukee meeting of the American Society of Mechanical Engineers. At one of the evening "functions"—a stag affair, where a spirit of conviviality reigned, the college man made himself conspicuous by the spirit of rivalry. Several institutions had a sufficiently large body of representatives to make decidedly noisy demonstrations with their college yells and songs, and at times the gathering might almost have been taken for a collection of collegians. While no count has been made, the occurrence testifies to the change that has taken place. In the early days of the society such a thing would have been impossible.

Other societies show the same condition of things. It was strikingly in evidence at the recent Saratoga convention of the American Railway Master Mechanics' Association. The attendance at that convention emphasized the fact that the old-time shop-bred superintendent of motive power is giving way to the man from the technical college; and not less striking than this general fact was the comparative youthfulness at which these men have risen to positions of large responsibility. In both the growth of the college men in numbers and in the rapidity of their progress lies a sufficient answer to Mr. Schwab's recent statement regarding the lack of value of education.

All this makes for American mechanical progress, and from that standpoint we rejoice in it. There is, however, another side to the picture, which is not so pleasant but to which it is not well to shut our eyes. We refer to the fact that by this very progress the outlook for the shop man is darkened. Hope is the mainspring of all human effort, and if the higher positions are to be closed to the shop man no American can regard the prospect with satisfaction.

We refer here, of course, to the higher shop or technical positions in which the change due to the newer education is showing itself. Whatever may be said of the larger business and administrative positions, education is demonstrating its value in technical work and it is on the line of technical work that most shop men must advance if they are to advance at all.

While the causes are entirely different, the effect of a kind of progress which largely bars the shop man from the line of promotion can only be to duplicate here the conditions that are characteristic of industrial life in Europe. There the workingman feels that he is born to a position in life from which he cannot rise. As he begins so will he end, and his whole line of effort toward bettering his condition is not to advance himself to higher and higher positions and responsibilities, but to improve in some small degree the conditions that surround him and his class—not to advance individually by extra effort and exertion, but to save his efforts and to conserve his strength with a view to present enjoyment and a lengthened period of productiveness. This is "horizontal stratification" as it is in Eur-

ope, and as no American who loves his country can desire to see it here.

To the fact that the stratification of society here is vertical instead of horizontal has been largely attributed much of such progress as we have made, and it is in the highest degree desirable that the condition of vertical stratification be preserved.

We are by no means alarmists in this matter. The American people have a way of solving problems as they arise, and to this situation an experimental solution is already being applied. We refer, of course, to the correspondence school system. This has not yet had time to demonstrate how much it can do, but it is more than probable that it will do much to overcome the tendencies we have noted. There are also other solutions of the problem which, however, have not gone beyond the stage of suggestion. There is the plan for a half-time school by Professor Higgins and the scheme for an engineering school of the highest grade, but founded upon the workshop instead of the high school, both of which would supply ever-present ladders of hope. We believe it to be of the first order of importance that the way of progress shall be kept open at the top, and we believe also that schools organized on these lines would furnish the best and most practicable way of doing it. There is the great school which Mr. Carnegie is to establish in Pittsburgh. Can any more fitting, more appropriate and, to its founder, more attractive program be imagined than the one here referred to? Is there any reason why it should not be adopted and carried to a conclusion which will accomplish more for good than is possible by a mere duplication of existing schools and methods?

The Injunction of Striking Machinists.

The existing strike in the machinery trades has been marked by an incident which has become common to labor difficulties. A manufacturing company has resorted to a court of chancery jurisdiction and obtained an injunction to restrain the strikers from interfering with its business or with workmen in its employ who are not participating in the strike. This injunction was issued in Milwaukee and is addressed to the International Association of Machinists, to three of its subordinate lodges and to thirty individuals mentioned by name, among whom is James O'Connell. The organization of employers in the metal trades is understood to have been behind the application, which was supported by the affidavits of Theodore Vilter and William O. Vilter, of the Vilter Manufacturing Company, and by those of three workmen who allege attempts made by the strikers to induce them to quit work.

The strikers are prohibited, first, "from congregating or being upon or about the sidewalks or streets or alleys or places adjoining or adjacent to the premises of said plaintiff hereinafter described or upon or about said premises."

The word "being" here gives, at first blush, the appearance of an unjustifiable attack upon personal liberty, as if the fact of a striker's simply walking along a certain street would render him liable to imprisonment. But it is an elementary principle of legal construction that words of a general character are to be understood in the light of the specific accompanying words. The manner of "being" enjoined against would therefore probably be taken to apply only to that sort which is objectionable for the same reason as "congregating," *i. e.*, that which assumes hostile aspect. The next prohibition is against "hindering or preventing or attempting to hinder or prevent by threats, intimidation, force, abusive language, duress or coercion of any kind any person or persons from engaging in or continuing in any work or employment for or on behalf of said plaintiff, or on or about its said premises."

This requires no particular discussion, since it seems to apply only to actual coercion, as does the next: "And from so hindering and preventing or attempting so to hinder or prevent, any person or persons from freely entering upon or leaving premises of said plaintiff."

More ambiguity is found in the following: "And from in any way interfering with or hindering or preventing or attempting to hinder or prevent the carrying on or management of the business of said plaintiff, and from trespassing on or coming upon said premises of said plaintiff."

If this were construed in a broad sense it would forbid many things which are undoubtedly entirely legitimate, as, for instance, attempting to hinder the carrying on of the manufacturing company's business by engaging in competition against them. In the narrower sense in which it is likely to be taken it may still include attempts to prevent them from obtaining men or materials for their work, although made through peaceable persuasion. The next clause is directed against:

"Compelling anyone in the employ of or seeking employment from said plaintiff to listen to any arguments of the said defendant or their co-conspirators or pickets or any of them against his will."

It is certainly cruelty to make a man listen to your talk when he doesn't want to, but how about the following:

"And from persuading or inducing in any manner any person to join in the organization or furtherance of any conspiracy to compel the plaintiff to give up or abate in any way its control of its factory and business."

Here a good deal depends upon the interpretation of the word "conspiracy." If the strike be considered such, as it is in a sense, then a machinist who invites another to join it might have to go to jail. If, however, a criminal conspiracy is meant, this prohibition may apply only to persuasions to join in a movement of the sort that the law would punish irrespective of the injunction. The next interdict is against "inducing by threats or otherwise any person or corporation to refuse to furnish or sell to this plaintiff or any of its employees supplies or other merchandise."

If the word "otherwise" is not here restricted by relation to "threats" it indicates that even a peaceful attempt to promote a boycott is illegal or has become so in this case. Finally the machinists are enjoined:

"From doing any act tending or intended to compel said plaintiff, against its will or the will of its officers, to operate its factory or employ or discharge any workmen in any manner or upon any terms prescribed or to be prescribed by any association or union, or to refrain against its will or the will of its officers from operating its said factory in any lawful manner, or to refrain against its will from hiring or discharging in any lawful manner such workmen or upon such terms as to the plaintiff or its officers may seem best."

What is here meant by the word "act" and the phrase "against its will"? Are we to understand that it may be a penal offense for the men in a shop to go on strike to secure the employment of a workman whom the company would prefer not to retain? Or will this clause and the others be strictly interpreted and applied only to acts of forcible coercion or on a par with it?

In reflecting on these complicated questions it is well to bear in mind two basic principles of law. First, an act legal in its nature may become criminal if intended to secure an illegal end. Second, acts which may be lawful for one man independently to do may be unlawful for two or more men by joint arrangement—*i. e.*, by a conspiracy. A "put-up job" to hiss an actor is an example of this.

In connection with the Milwaukee injunction it is worthy of note that a court in Chicago has just sustained the legality of blacklisting by employers, a decision which is at variance with the law as interpreted in some other States.

Technical Publications.

"How to Become a Good Machinist." By John Phin. Second Edition. Rewritten and Greatly Enlarged. Industrial Publication Company. 68 pages 5x7¼ inches. Price, 25 cents.

This book advises the learning of arithmetic, algebra, geometry, the elements of natural science and drawing, and gives a few hints as to how to set about it. An appendix makes the tides the motive power of the future.

"The A B C of the Telephone." By J. E. Homans. 335 5x7-inch pages, with 268 illustrations. Theo. Audel & Co., New York. Price, $1.

This book belongs with the best class of popular scientific literature. While it is strictly elementary, in the sense that it begins with the elements, it nevertheless gives a very comprehensive survey of the entire field of telephone apparatus and construction. From this point of view we do not regard the title as altogether happy. The leading steps in the development of the telephone are given, together with a description of the leading forms of switchboards and other accessory apparatus and the various systems of wiring, automatic exchanges, line construction, etc. In order that the book may be fully comprehended by the beginner, the discussion of the telephone proper is preceded by an admirable chapter on the theory of sound and by another on the fundamental principles of electricity. While not a "primer," the book is thus one which anyone can read if he has enough interest in the subject to try.

The Goulds Manufacturing Company, of Seneca Falls, N. Y., write us as follows, June 29: "As a matter which may be of interest to your readers, we beg to state that labor troubles with our men who have been out since May 20 have been adjusted and work will be resumed in both our factories on Monday, July 1. The men return to work under a private arrangement just effected."

Commercial Review.

NEW YORK, Monday, July 1.

MACHINE TOOLS AND OTHER MACHINERY.

Barring any temporary check that may have come from the prevailing hot wave the machine tool market seems to be running along about as it has been doing with some little accentuation on wareroom floors of the effect of hindrances to tool shipments where strikes prevail. In standard tools, such as lathes, there is considerable complaint of shortage. Tool manufacturers, however, seem in some cases to have anticipated the strike by working up to the last at full pressure to provide themselves with stocks against an evil day. In one case a manufacturing company is said to have been preparing a long way ahead and to have filled up its floors altogether too full, as it seemed at the time, but now the stock is so reduced that a little more of it would be greatly appreciated.

There is no perceptible change in the German-American machinery trade situation and English demand is pronounced also flat.

The orders booked by the Niles-Bement-Pond Company for the half-year just closed are expected to foot up to a larger total than those of any other six months in the company's history. The fact of the company's having recently taken over the Pratt & Whitney Company and the receipt of a large contract from the British Westinghouse Company, however, preclude much generalizing as to market activity from this relative showing.

The Prentiss Tool & Supply Company's June business exceeded that of May and is considered about equal to trade a year ago. There is definite prospect that its orders this month will be in excess of those for July last year.

Last week we mentioned the opening of a branch store at 200 Franklin street, Boston, by the Prentiss Tool & Supply Company, New York, and gave the names of several of the manufacturers for which agencies are held by it. We are requested to add that the Acme Machine Screw Company, Hartford, Conn., is another of these. Further, the Prentiss Tool & Supply Company holds agencies for the L. W. Pond Machine Company, the Newark Machine Tool Works and others. The company has now a branch store in Pittsburgh, Pa., located on First avenue.

The machinery, tools, fixtures, models, patterns and good will of the Westphal Machine Company, of Holyoke, Mass., builders of grinding machines and buffing lathes, are being offered for sale by John C. Meyer & Co., 80 Kingston street, Boston.

The Brown-Corliss Engine Company has let to Pawling & Harnischfeger, of Milwaukee, the contract for electric cranes to go in its plant at Western Union Junction, near that city. The American Bridge Company has the contract for the buildings.

We have received a communication from Deputy Consul-General Simon W. Hanauer, at Frankfort-on-Main, Germany, calling attention to the industrial progress of Japan. Formerly Japan paid annually millions of dollars to England for warships, armor plate, steel rails, etc. Now the Japanese have steel works that turn out armor plate and other shipbuilding material. They construct their own vessels and manufacture rails and other railroad equipment. The consul is inclined to rate highly their prospects for competition in these lines abroad. As yet, he admits, Japan's manufactures are imperfect and of a low quality and her mechanics less skilled than those of the United States and Western Europe.

SUGGESTIONS OF THE ENGINE BUILDERS.

Those who are in touch with the steam-engine selling trade in such a market as New York city know the delicacy and often great difficulty of maintaining satisfactory relations with contractors and engineers. The necessity for personal tact seems to be greater in this than in almost any other department of the machinery business. An attempt to untangle any of the manifold snarls that occur in this class of dealings is an effort well-directed. The Engine Builders' Association at its Indianapolis meeting, May 27 and 28, formulated certain suggestions which they hope will be approved as reasonable and adopted by architects and engineers in drawing specifications for plants. These suggestions are as follows:

First: That contracts which provide a penalty for failure to deliver in time or for failure to meet guarantee ought also to provide equal premiums for earlier or better results than specified.

Second: That bonds should not be required on installation contracts unless corresponding bonds for similar amounts are given to secure payments, an exception always being made in the case of government, state or municipal contracts.

Third: That settlements or any part of them ought not to extend beyond three months from completion of contract, and that delay on the part of the owner ought not to delay payment beyond a reasonable time.

Fourth: That a guarantee against defective material or workmanship should not be made to cover a period of more than one year from date of shipment.

Fifth: That purchasers of engines ought not to be furnished with complete working drawings, but simply with general drawings showing the assembled engine in outline, with such principal dimensions as will answer for building foundations, the erection of engines or their care.

AMERICAN MACHINERY AND TOOLS IN RUSSIA.

Previous to the late tariff embroglio the value of United States exports to Russia of various discriptions of machinery amounted, roughly speaking, to three million rubles a year. Germany sent about 36 to 37 millions and Great Britain 27 millions' worth of such merchandise. It may therefore be judged what a vast market there is for American goods in Russia. If American exporters can send machine tools and all kinds of appliances to England in the face of strong British competition, why (barring the tariff) should they not ship those goods to Russia in infinitely larger quantities than at present? The 3 millions of trade mentioned above do not include United States machinery reaching Russia via England and Germany, nor that entering by the ports of the Far East, whither large quantities of machinery and steel and iron goods have been imported. The Siberian Railroad will be an important factor in this import trade.

As regards Siberia itself, the first and foremost article for which an opening exists is machinery in its widest sense. The long railway, with its numerous auxiliary lines of connection will for years to come need rails and rolling stock; the seas and rivers need ice-breakers, dredgers and steamers; the mineral sections want boring, washing and all other appliances; the forests sawmills; while farm implements are in constant demand, also peat-drying apparatus, electric light plant, and so on.

There are a few factories for building locomotives being erected in Russia and large quantities of tools are wanted in con-

nection therewith. In Samarkand (Turkestan) there is a demand for rice-cleaning machinery of the newest type. If any United States firm dealing in this line won a prize at the Paris Exposition they would stand a first chance of getting orders. There is, too, a favorable opportunity for securing important contracts for manual fire engines, trucks, etc., in Russia, as volunteer fire brigades are now being organized throughout the Empire. The ever-alert Germans are in the field and are believed to have gotten orders for several thousand of such appliances. The need for an adequate fire protective service will readily be understood when it is stated that one-fifth of the wooden houses in Russia are burnt down every year. The payment for the fire appliances is usually guaranteed by the various municipal authorities whose note is invariably discounted by the local bank, where the goods are consigned.

Type-casting machinery is also required. It must be fast-working steam machinery for casting type and spaces and capable of producing about 108 pounds nonpareil per day. It would probably be best for the manufacturers to give all descriptions of these particular machines in German as well as in Russian.

The local agricultural societies in Russia find that there is a steady request among the flax cultivators for flax dressing machines, both the cheaper hand-made kind and the more finished metal article of foreign manufacture. So strong has been the demand, even among the peasants, that the societies have themselves undertaken the distribution of said machines and have also established, in connection with the Russian Department of Agriculture, a series of flax dressing and seed stations, providing them gratis with a complete collection of the requisite machinery and tools. The Department of Agriculture is the central authority in this matter.

In Warsaw there is an opening now for cheap calenders. Some British houses supply them but charge a good price and the Germans make a cheap article. The calenders at Warsaw are either of about 8½ tons, costing $1,370 in the United Kingdom, or of smaller sizes weighing about 5 tons, which cost about $750. In spite of a duty of 2 rubles and 10c. per pood (representing generally 50 per cent. or 100 per cent. of the value of the machinery imported), quite 80 per cent. of the iron manufactures used in Russia are of foreign make. For instance:

	Price at Frontier.	Duty.
Stone crusher.....	$500	$350
Steam engine.....	3,000	2,000
Boiler.....	1,750	1,350
Lathe.....	300	135

It does not seem to be a bad speculation to set up factories in Russia for the manufacture of these goods, as it could be done with a large profit behind such a tariff wall as that. The Russian Government encourage this movement, as their aim is to make Russia quite independent eventually of all foreign goods. But in spite of this protection foreign machinery will be largely imported for years to come. Some new machinery factories have been started of late years, but so far they have not shown themselves to be very formidable competitors. In the South of Russia there is an exceptionally good demand for mining and metallurgical machinery, pumps, files, hammers, shovels, coke forks, machine tools, etc., the United States supplying large quantities of the latter goods.

It would not be a bad idea if a dozen or so American makers could arrange to open a permanent sample room, say at Odessa; the samples, catalogs, etc., could afterward be sent from time to time to the many exhibitions held in various towns throughout the country. These exhibitions are well attended and each of course would probably result in many orders.

F. C. C.

CHICAGO MACHINERY MARKET.

For second-hand engines there is a brisk demand. The representative of one large engine builder says that buyers usually want deliveries of engines and boilers the day before they inquire for them and that, finding an interval of three or four months at shortest before shipment can be made, they look about for a second-hand engine as a substitute. So keen is this demand that dealers have lately been actively searching for sellers and, wherever possible, securing options from the owners of engines who are soon to replace them with new power. The same individual ventures the prediction that in several months there will not be a second-hand engine of any consequence to be had. It is the question of delivery more than of price that is giving this trade its special activity.

Comparisons are commonly being made between the business of June this year and that of June last year and between the first six months of the two years. Almost or quite without exception the comparison is favorable for the present or recent trade. Considerably more business has been placed in June this year than in the corresponding month of 1900. Inquiries are numerous. All indications point to an active trade in boilers and engines during July. It is not uncommon for some makers to pass by inquiries without quoting.

Filer & Stowell have sold to the Inland Steel Company, of Chicago, twin heavy duty rolling-mill engines, 34x60 inches, of 3,000 horse-power, to be installed in the new rolling-mill plant to be erected at Indiana Harbor near Chicago. They have also sold a 700 horse-power of heavy duty type to the Grand Rapids Railway, to furnish additional power.

The Waterloo Gas & Electric Company, Waterloo, Iowa, have bought from the Buckeye Engine Company one engine of 450 horse-power and one of 225 horse-power, and boilers to furnish steam for same, from the Babcock & Wilcox Company.

A. L. Ide & Sons have sold three high-speed engines of 350, 300 and 75 horse-power respectively, to the St. Louis, Iron Mountain & Southern Railroad, for installation at the new shops at Baring Cross, Ark.

Abendroth & Root Manufacturing Company has sold boilers of 1,000 horse-power to the Centennial Eureka Mining Company, Salt Lake City; of 450 horse-power to the Evening Mining Company, Deer Lodge, Mont.; two of 110 horse-power each to the Toledo Match Company, and one of 250 horse-power to the Chicago Bridge & Iron Company, Chicago.

Among recent orders of the Heine Safety Boiler Company are the following: Two boilers of 250 horse-power each to the Laclede Fire Brick Company, St. Louis; one of 428 horse-power to the Sheffield Milling Company, Faribault, Minn.; one of 580 horse-power to Jos. S. Kirk & Co., Chicago; one of 250 horse-power to Roy & Titcomb, Nogales, Ariz., and one of 150 horse-power and one of 250 horse-power for cotton mills at Honey Grove, Tex.

Quotations.

NEW YORK, Monday, July 1.

Pennsylvania Foundry Pig Irons, Jersey City delivery, good brands:

No. 1 X.....	$15 15 @ 15 50
No. 2 X.....	14 65 @ 15 15
No. 2 plain.....	14 15 @ 14 65
Gray forge.....	13 75 @ 14 50

Alabama Pig, New York delivery:

No. 1 foundry, or soft....	15 25 @ 15 50
No. 2 foundry, or soft....	14 25 @ 14 75
No. 3 foundry.....	13 75 @ 14 00
Foundry forge, or No. 4..	13 25 @ 13 50

Bar Iron—Base sizes—Refined brands, mill prices on dock, 1.58 @ 1.65c.; from store, 1.80 @ 1.90c.

Tool Steel—Base sizes—Good standard quality, 7c.; extra grades, 10c. and upward.

Machinery Steel — Base sizes — From store, 1.90 @ 2.00c.

Cold Rolled Steel Shafting—Base sizes—From store, 2½ @ 2¾c.

Copper in carload lots—Lake Superior ingot, 17c.; electrolytic, 16⅝c.; casting, 16⅜ @ 16½c.

Pig Tin—28.20 @ 28⅜c., for 5 and 10-ton lots, f. o. b.

Lead—For wholesale lots, 4⅜c., with .02½ @ .05c. extra for carloads.

Spelter—3.95 @ 4c., New York.

Antimony—Cookson's, 10¼ @ 10⅜c., while other kinds are generally from 8½ @ 8¾c., according to brand and quantity.

Lard Oil—Prime City, 70c. for jobbing lots in an ordinary way.

Shops of John Lang & Sons, Johnstone, Scotland.

What impressed me as one of the best and most progressive machine-tool building establishments in Great Britain is that of John Lang & Sons, which is located in Johnstone, near Glasgow. Their work is mostly what would be classed as light, and none of it is, I think, heavy. Small and medium lathes are their specialty, and, unlike most British machine tool shops, they confine their product to comparatively few lines; another point of variance from the general British practice being that they manufacture and put tools through the shop in lots; often ahead of the orders actually in hand; so that they can, under normal business conditions, usually make prompt deliveries quite as we usually do here. When I visited them in 1897 they told me they had not seen a slack time for twenty-one years. A good many American tools were at work in their shops; they seemed well informed as to American shop practice and were making the Gould & Eberhardt automatic gear cutter—modified, of course, "to suit British ideas." They said that most American tools were too light, but were fully awake to the importance of handiness in a machine tool. Their own lathe they referred to as being "as smart as any American lathe."

At the time of my visit they were building an addition to the works, which was to be devoted solely to the manufacture of lathes of small sizes, and I am not sure but only one size.

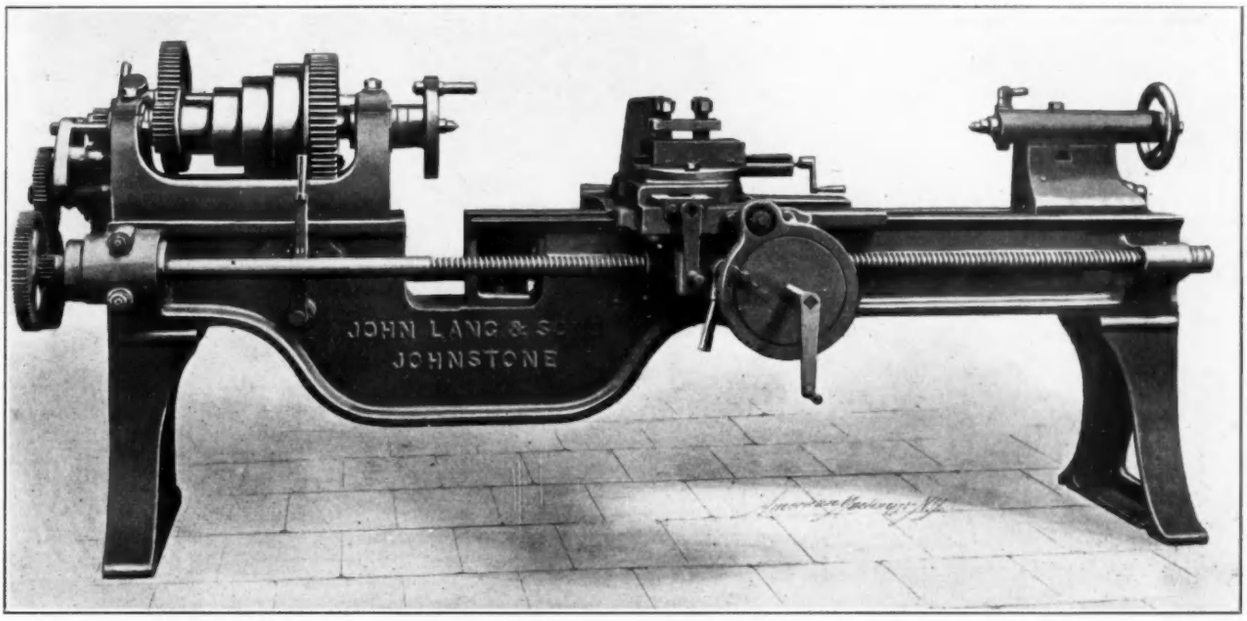


FIG. 1. 16-INCH LATHE BUILT BY JOHN LANG & SONS, JOHNSTONE, SCOTLAND.

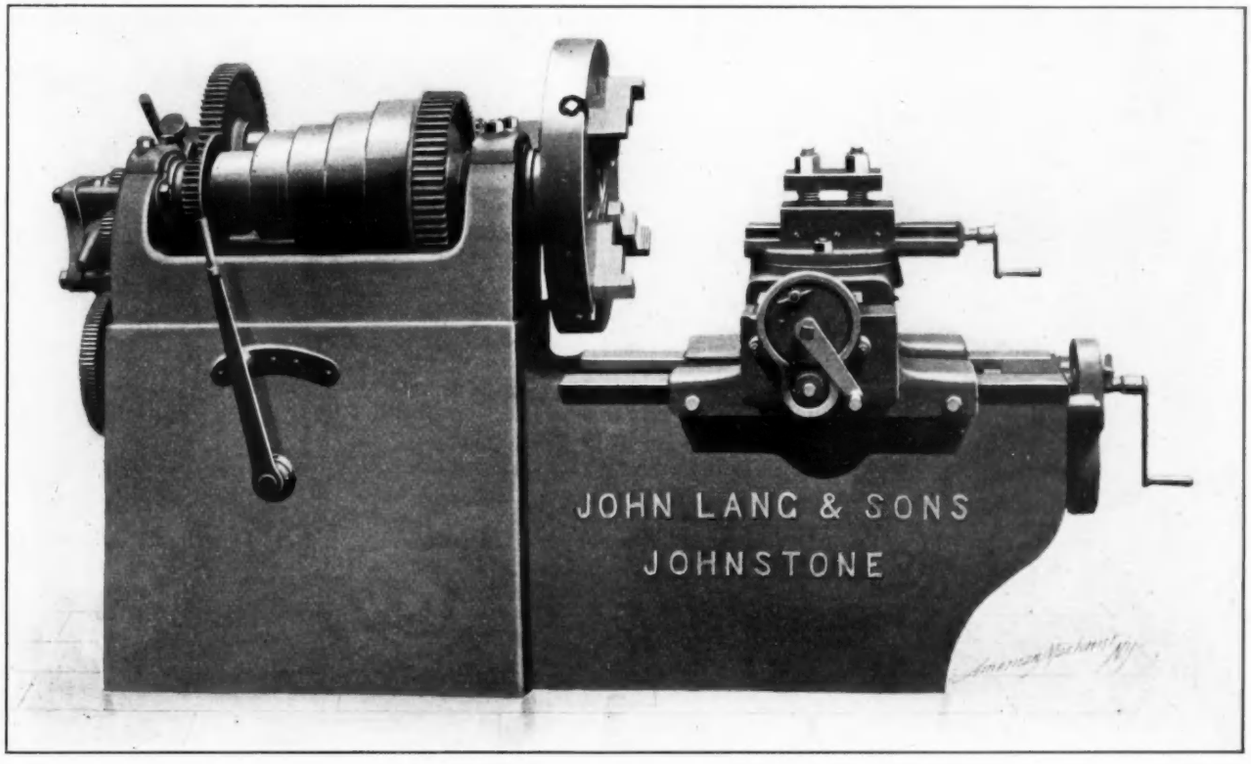


FIG. 2. 30-INCH SWING SURFACING AND BORING LATHE.

Fig. 1 shows their lathe as then made, and I presume it has not been materially altered since. This they call their 8-inch center, self-acting, sliding, surfacing and screw-cutting lathe, which means the same as we in America mean when we say 16-inch engine lathe with automatic cross-feed. It is not the same lathe, however, as will readily be seen. The spindle is solid; the feeds are by gears only; there is the gap with removable piece to make it wider, and there is the strap tool-holder, with no provision for vertical adjustment of the tool except by packing strips placed under it. There is a rod feed, but the rod is at the back and drives a shaft which crosses through the saddle to the front, where it has a pinion that drives the larger gear, and the rack is behind the screw. Gears within the bed provide for three different rates of feed, 1-32, 1-20 and 1-12 inch. This arrangement of feeds shows, I think, as clearly as any other feature the different standpoint from which a lathe seems to be regarded here and in Britain. A 16-inch lathe would not do here at all, unless the carriage could be fed much finer than 1-32 inch, though we would of course have use for the coarser feeds, and occasionally for feeds much coarser than 1-12 inch. It is true that finer feeds can be obtained by the compound rest slide, moving it by hand, and coarser ones by means of the lead screw; but neither of these methods would answer here at all, nor would it do at all to have the feed clamp placed near the periphery of a rotating wheel, so that when the workman went after it he would find it sometimes in one position and sometimes in another, depending upon chance. I mention these points, not to discredit the Lang lathe in the least, but simply to call attention to what appears to be an utterly different way of looking at the problem of lathe construction and the practice of lathe manipulation.

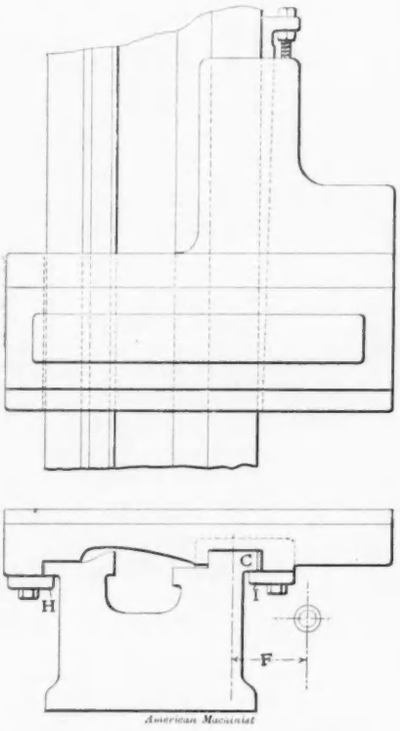


FIG. 3. IMPROVED FORM OF SADDLE BEARING.

The footstock is clamped to the bed by an eccentric and lever; all gears and the rack are cut, and the spindle has its bearings finished by grinding. The lead-screw is, I firmly believe, much better than our usual one of about half the diameter and one-quarter the pitch.

A specialty with this firm also is the type of machine shown in Fig. 2, which is a "30-inch swing surfacing and boring lathe." This is their 20-inch lathe headstock placed upon a bed, as shown, and the saddle is moved upon the bed by a screw. The feed motions are the same longitudinally and crosswise, and three rates—1-20, 1-10 and ¼ inch—are obtained by moving the lever seen in front of the machine. This tool, like the lathe, has flat slides with beveled edges, but the more recent ones have guiding surfaces arranged as shown in Fig. 3, which seems to me to be a great improvement. The broad, flat surfaces are retained, but the edges are at right angles to them, and the lateral guiding surfaces are both in front and close together. A single long taper gib enables lateral wear to be taken up, there being no bearing upon the edge of the bed at the rear.

Quite recently Messrs. Lang & Sons

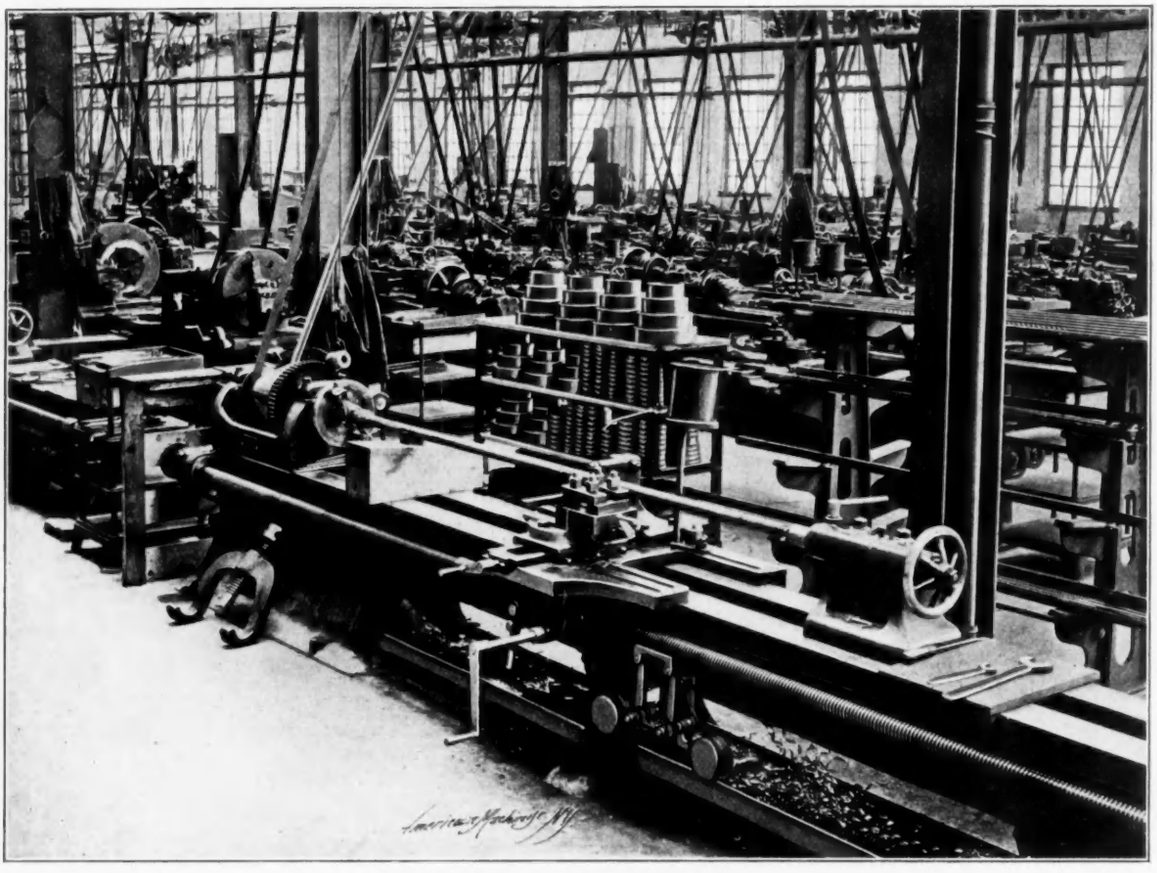


FIG. 4. VIEW IN NEW TURNING SHOP.

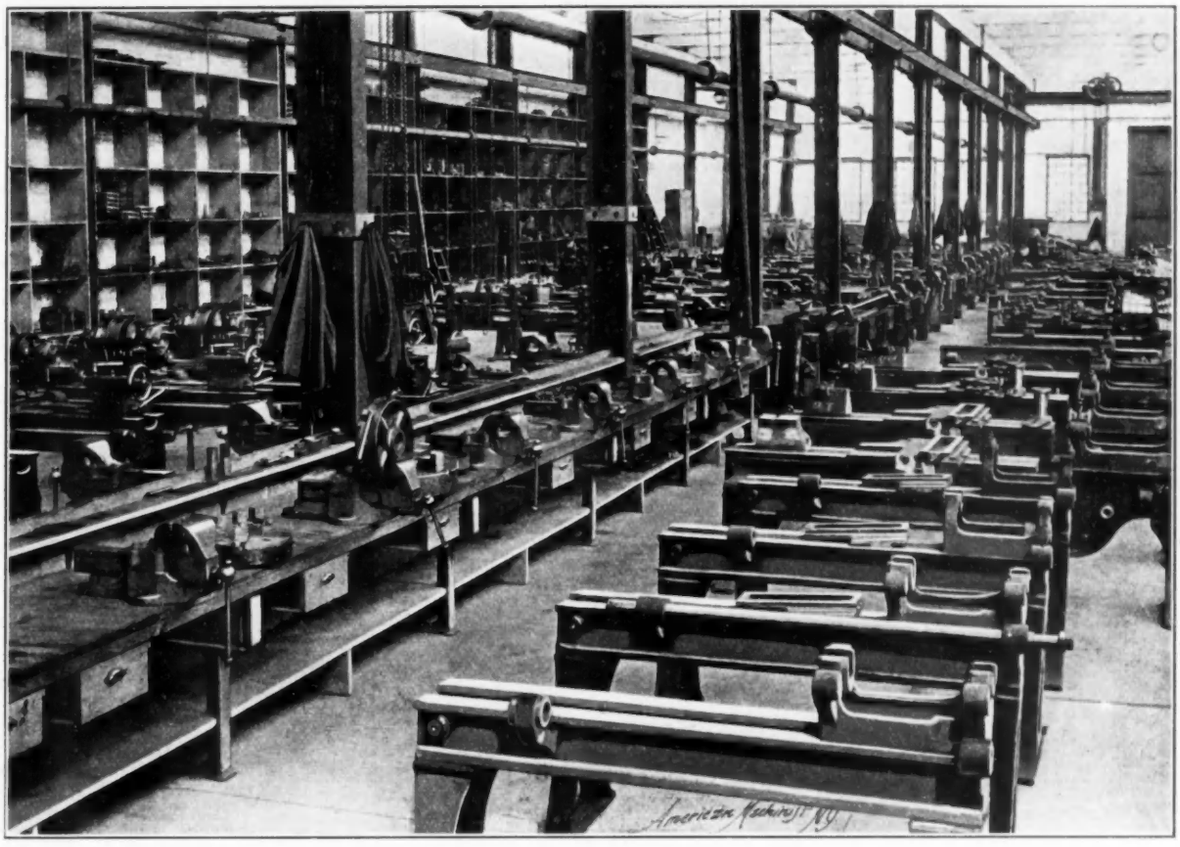


FIG. 5. FITTING AND ERECTING SHOP.

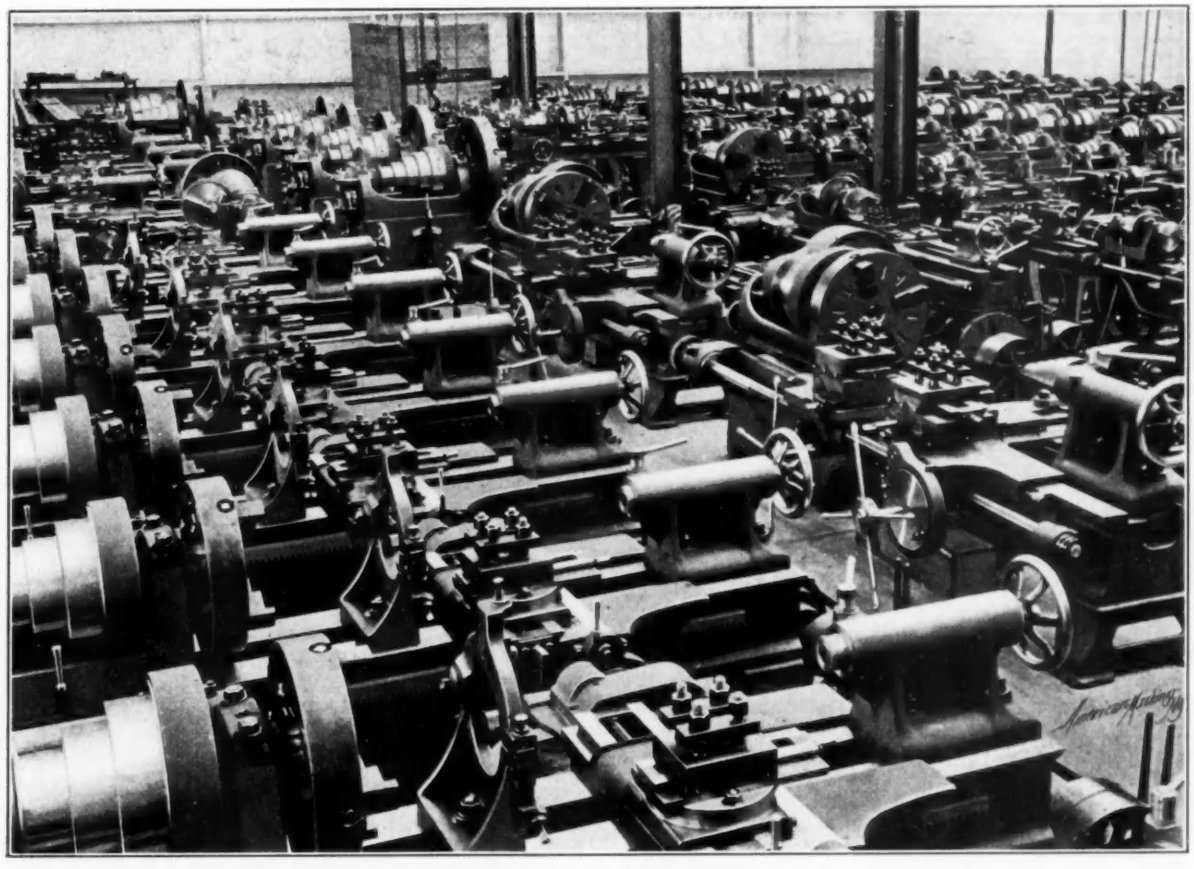


FIG. 6. FINISHED WORK AWAITING SHIPMENT.

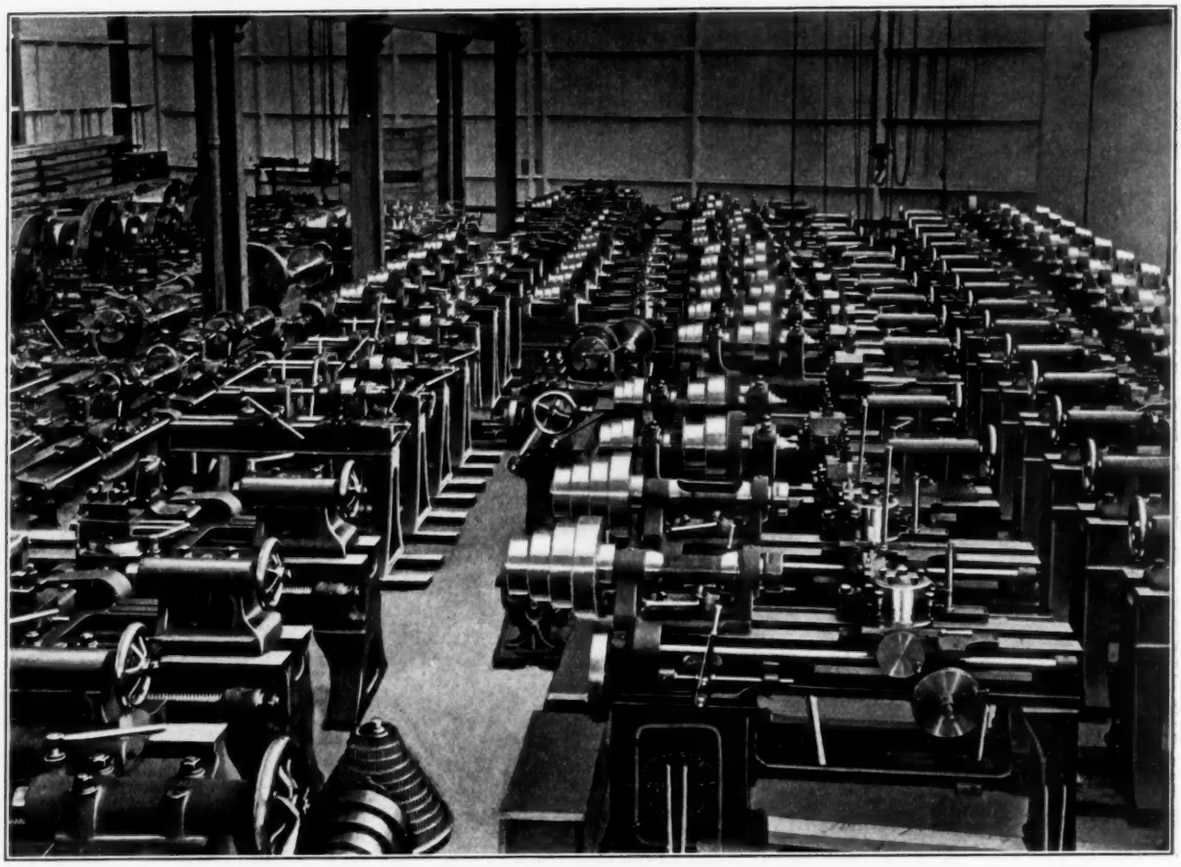


FIG. 7. FINISHED TOOLS AWAITING SHIPMENT.

FIG. 8. VIEW IN NEW SHOP.

have secured about 16 acres of ground and have commenced a series of buildings which will bring their entire works within one enclosure. The new buildings have saw-tooth roofs with north light, traveling cranes and all improvements. The first building erected is 300 feet long, 100 feet wide, the width being divided into four equal spaces.

The photographs give views in this building. Fig. 4 is a view in the turning shop, and it will be noticed that a prominent feature are the stands for holding work and tools, which conduce to neatness and good order.

Fig. 5 is a view in the fitting and erecting shop, showing bins for finished parts, vise bench and crane.

Figs. 6 and 7 show finished tools in stock. Both are taken in the same room, and most of the lathes seen are to fill one order, the delivery of which awaits the completion of new buildings in which they are to be placed.

Fig. 8 is another view in the turning shop, and at the right will be noticed some lathes having the improved form of bearing for the saddle upon the bed. These lathes are without the compound rest and have the American form of tool-post. They are without back gears, and I suppose are designed for a special line of very light work. F. J. M.

Tube-Forming Tools.

BY B. J. DOUGHERTY.

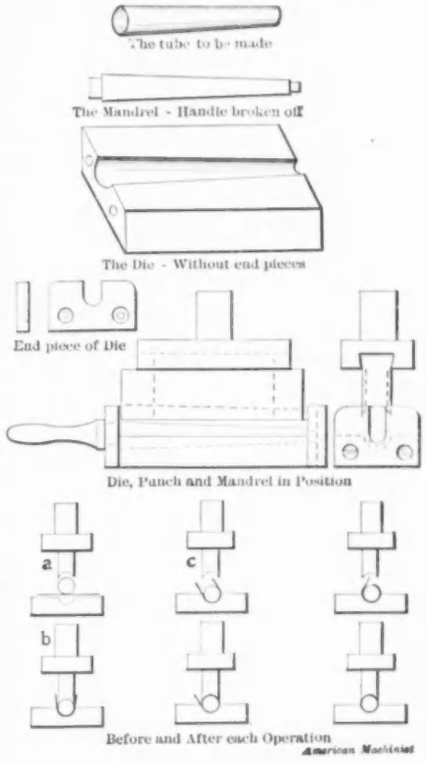
There are several different methods of forming sheet metal into tubular shape, many of them good, but each having some peculiar advantage over the others, according to circumstances, such as material, thickness of metal, whether butt or lap joint, parallel or taper, or what may be the financial condition of the customer ordering the tools. It seems strange that the latter should have anything to do with how the tools should be made. To men that have worked in Brown & Sharpe's, Pratt & Whitney's, gun and sewing-machine shops, or any of these places where the best is hardly good enough, this will read like rank heresy. But when it is taken into consideration that a large proportion of the people that use such dies in manufacturing are men of small means with shops in basements and attics all over New York city (and all over the country for that matter), some are inventors, with their ideas in the experimental stage, still others are in the novelty business whose goods may sell for one season only, and that a very short one, and the tools are then of no use to them, it will be easily seen, then, that it is impossible to have only one grade or standard of work. Certainly the cheapest of them must be good, but it is easy to double the cost of dies, although the quality of the work may not be 10 per cent. better.

With this explanation I will try to describe a set of tools for forming taper tubes from tin or other light gage metals. For convenience I call them tubes. The method is used in making tin teapot spouts, dipper handles, blow horns, oil-can spouts, tin whistles or flutes, etc. I confess that when I first saw these tools I thought them decidedly crude and unmechanical. I am of the opinion still that they were never devised by a machinist, but were originated by some old-time sheet-metal worker in an even cruder form, the same as a great many other ideas in this line which the machinist has been quick to seize and call his own, with some improvements of course. They have so improved some of them and combined the operations so elaborately that the poor sheet-metal worker has not recognized them as his own, and so has been cheated out of any credit due him—it's the way of the world. I have made many of them since, and have found that in making taper tubes that call for lap joints they do excellent work, with the added merit of making butt joints equally well. Their fault is that for heavy metals they are worthless. There are other methods of construction for heavy metal. It may be understood here that we have the blanking die all right, and have the blanks ready to make the tubes, although it is not the practice in the shops to make the blanking or cutting die first.

These tools have this advantage over others from a financial standpoint, that one punch and die only is required to complete the tube; but three blows must be struck, thus making three operations, and it is best to use them in a foot press. A writer in the "American Machinist" recently showed some dies for blanking out a wheel. In one of the dies the press had to make three strokes to complete the perforations between the spokes, which he figured out as one operation. I take this opportunity of informing him that every stroke of the press which involves handling the metal is counted as an operation, although they are all on the one die.

Fig. 1 is the tube to be formed, Fig. 2 the mandrel, Fig. 3 the die, Fig. 4 punch die and mandrel, Fig. 5 *a*, *b*, *c*, *d*, *e*, *f* are working drawings, Fig. 6 shows the method of operating.

A mandrel is used with this die, and end pieces are put on the die to guide it into position when working. The die is always made longer than the tube required because the metal springs back somewhat and the amount it springs back is hard to determine when commencing the job, no matter how much experience the mechanic has had. Soft metal will spring less than hard, heavy metal less than lighter, the small end will spring much less in proportion than the large one. As the taper increases the amount of spring at the large end increases, but not in the same ratio. So, then, if a die was made exactly the same size as the model or sample it would produce a tube quite different in diameter and taper. This is one of the cases where a green man gets left; he can't say "I worked to the drawing." He is given a model or sample to make; he has not the dies but the work to work to. The old hand does not get rattled so easily; he knows there is some uncertainty of results and tries to anticipate it. The first step is to make the die and mandrel much longer than the sample tube. By doing this the diameter question is easier settled, because the gages (between which the blank is placed) can be adjusted anywhere along the die to bring out the right diameter. If the gages were placed on the die to bring the blank in the center of the die lengthwise, and a tube was rolled up in it which was too large, then the gages could be moved towards the small end; if it comes out too



FORMING TAPER TUBES.

small then move the gages, of course, the other way. A few trials will show the right spot where the gages should be pinned down.

Thus one element of uncertainty is eliminated easily; but not so the other. That is: How much more will the metal spring open at the large end than at the small end? There is nothing for this but to cut and try. It may be learned from this that the idea now is not to make the mandrel like the sample tube, but to make it of such a shape that when the tube is removed from the die it was formed in, the spring in the metal will cause it to spring open to the exact shape and size required.

Alas for the methodical fellow with his little note book of records; the last one he made was for a tin blow-horn, about 18 inches long, with the largest diameter nearly 2 inches; the one he made before that was of soft brass, 3-16 inch at the

largest diameter of the tube, for a fountain pen; previously he made one for an oval tube. So he finds his data of no use in this case, and, besides, he is going to use aluminum. Cut and try, then, it must be; but how to do it at the least cost is the problem.

As it is certain, under any circumstances, that the metal will spring back most at the largest end of the tube, the mandrel is turned up somewhat less than the taper required, by the best guess than can be made. This is the starting point. The space to receive the mandrel and sheet metal is cut out of the die and punch. How this operation is done depends on the facilities of the shop. It would not pay to make a reamer, because you are not sure of the shape or size. They usually plane them out on the shaper, finishing with the file and scraper. It need not be highly finished at first; just good enough to roll up a tube and get results. This is done by setting the die and punch in the press, placing the mandrel in its place when setting. The mandrel is removed, a blank is placed on the die with the mandrel above it. A stroke of the press forces the mandrel and blank down into the die, and the metal is thus formed into the shape of the letter U. The punch ascends, the metal is tilted over by hand to one side; this brings one edge of the U directly under the face of the punch. It is not important as to how far it is tilted over; anywhere under the face of the punch will do, as it naturally finds its own place near the center. The punch again descends and closes this edge. One edge now remains to be closed; this is tilted over as the other was, and the punch descends and completes the tube. The mandrel is taken from the die, another blank is placed on the die, the mandrel is placed as before, and so on.

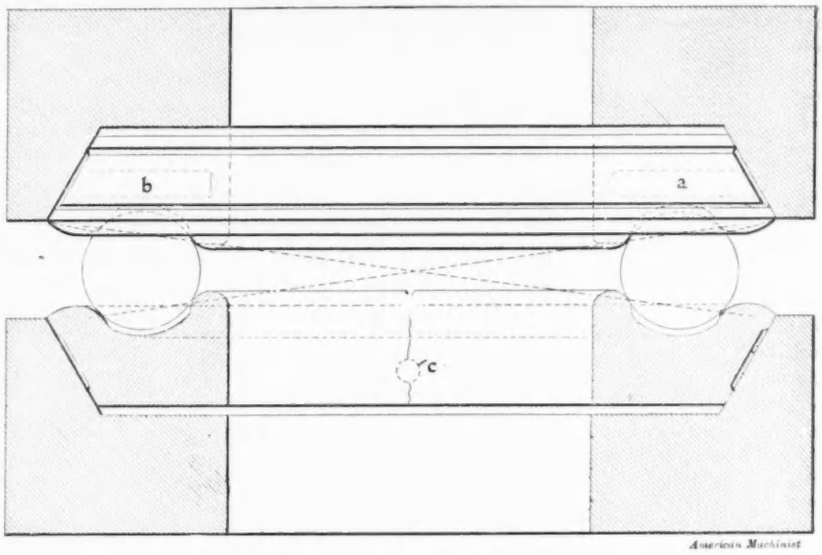


FIG. 1. SECTION OF THE BEARING.

The tube produced is compared with the sample, and if it is not what it ought to be there is nothing for it but to put the mandrel in the lathe again and alter it to what may be thought will be just right, which can be done with some certainty at this stage. The punch and die must be refitted as before, and the forming repeated. If still not just right, alter again; then at the last finish everything up nice and smooth, so that the dies will not mark the metal.

The operation of these tools may seem slow to read about, but in reality it is not. The amount of work a boy can produce with them on a foot-press is astounding, especially if he is working piece work. It may be observed that the fact that one edge of the tube is closed before the other, is the reason why tools made in this way are best for lap joints. The last edge to be formed is closed right on top of the first. These dies should always be worked in a foot-press, because the operator's hand and feet can work in unison, and he has some control over the stroke, thus reducing to a minimum the danger of chopping off the ends of his fingers.

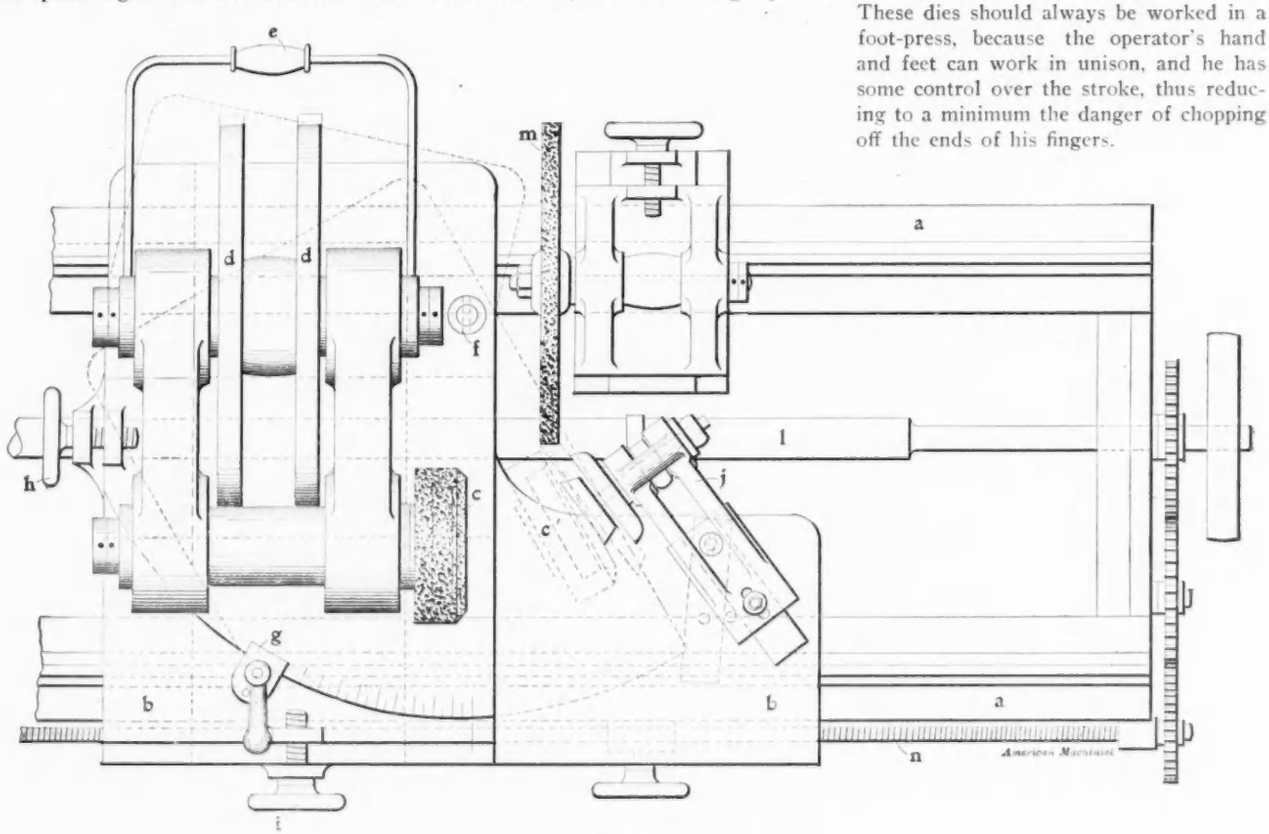


FIG. 2. PLAN OF GRINDING MACHINE.

The Auburn Ball Bearing and Grinding Machine.

Fig. 1 of the accompanying illustrations is a section of the Auburn bearing, a special feature of which is that it is a four-point bearing, the form of the races being the same whether the bearing is used as a journal or as a step. The bearing points in the races are located on the surfaces of two imaginary covers whose apices meet as shown. The outside surfaces of the races where they bear in the supporting seats are coned, there being no bottoming on the end surfaces.

If the bearing is to be used in a location which requires the races to be in halves in order to place them in position, they are broken in halves after hardening. Before hardening holes are drilled diametrically opposite and pins are inserted as indicated at *a b c*. V-notches are cut in the ring to locate the break, these notches being indicated but exaggerated in the figure. After hardening and grinding the races are broken in a press. The weakening effect of the pin holes and the notches compels the rings to part at those points and the breaks being more or less irregular the pins remain in one half and with the irregularities of the fractures act as dowels when the parts are put together again. Moreover, the races being seated on conical surfaces the pressure which the bearings have to carry naturally causes the break to close closely and to so remain.

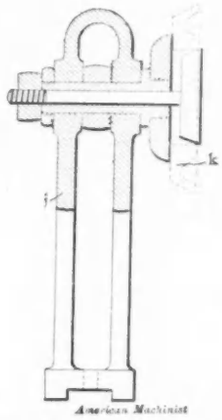


FIG. 3. CHUCKING THE WORK.

In the construction of four-point bearings a high degree of accuracy is of course essential in order that the balls may bear at all four points as intended. This accuracy is essential in both ball race and the outside or seating surface—absolute concentricity of this surface with the race being obviously imperative.

Fig. 2 is a plan view of a special grinding machine for making the races. On a bed *a* of the lathe type is a carriage *b* which carries a cup emery wheel *c*. Wheel *c* is driven by friction pulleys *d d*, which are forced to contact by an eccentric bearing manipulated by the handle *e*. The supporting bearings of the emery wheel may swivel about the center *f* in the carriage *b* and are shown so swiveled by the dotted lines. In this dotted position the cup wheel is shown in a grinding position *c'*. The angle of swivel is read from the graduated arc and a clamp *g* binds the parts in position. The wheel may also be adjusted lengthwise and crosswise of the bed by hand wheels *h* and *i*. At *j* is a support for the bearing to be ground, the bearing *k* being chucked in the manner indicated in Fig. 3. The bearing is driven by a belt from shaft *l*, Fig. 2, and its support may also slide and swivel on the carriage *b* and by means of these adjustments and those of the emery wheel the angles and diameter of the work may be varied at will. At *m* is a second emery wheel which grinds the outside cone seat at the same time that the ball race is ground and thus secures concentricity. The feed shaft *n* reciprocates the work in front of wheel *m* in the usual manner.

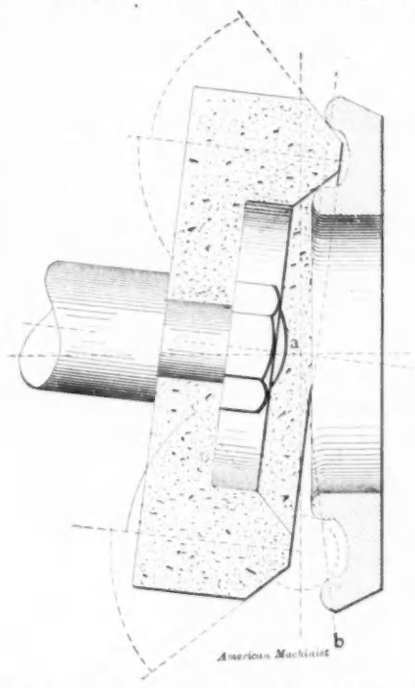


FIG. 4. RELATION OF BALL RACE AND CUP WHEEL.

Fig. 4 shows the relation of the race and cup wheel. The points ground lie in the elements of the flat core *a b* while the actual surface ground is of course tangent to the balls at the points where they are cut by these cone elements.

The bearings are the product of the Auburn Ball Bearing Company, of Auburn, N. Y.

The Change in the Conditions of Success.

It cannot be too thoroughly appreciated that the vast development of mechanical engineering work which has been going on in the past half-century, and which is still going on at an ever-increasing rate, is producing a most important change in the conditions which secure both professional and commercial success. In the old days our leading firms of mechanical engineers had comparatively few customers; and they had, as a rule, to meet the great variety of requirements of those customers to the best of their ability. Repetition work was comparatively rare, and success depended largely on resourcefulness and the power of entering thoroughly into the conditions to be fulfilled. Nowadays the successful mechanical engineer is not he who makes a great variety of things for the few, but a small variety of things for the many; at the same time producing those few things in the most perfect way. Such a manufacturer will not be confined to his own country for the sale of the machinery he produces, but will be able to supply the markets of the world.

One of the most striking differences between savage and civilized life is that due to the development of means of transport. The uncivilized man must, as a rule, draw his supplies from his immediate surroundings, while the inhabitant of a country like ours has practically the products of the whole world at his command. Year by year the barriers of time and space which divide nations are being reduced by the improvements in steam navigation, in railways, and in the means of telegraphic communication; and not only are we thus enabled to draw our supplies from all quarters with ever-increasing facility, but we are also enabled more and more easily to distribute our products to distant markets instead of being compelled to find an outlet for them near home. But while we are able to do this, other nations are also able to do the same thing. New countries are continually being opened up, and these countries will demand for their development the bountiful aid of the mechanical engineer. They will need railways and rolling stock, bridges and structural work, machinery of endless kinds; and, as a rule, they may be relied upon to satisfy these requirements by purchases in the most favorable markets, unbiased by any sentimental regards for kinship. Now, what we have to face in this new century is the cosmopolitan competition which this state of affairs engenders, and this is a matter which demands the most earnest consideration from all interested in our national progress.

I have said that the most successful mechanical engineers of the present day are, as a rule, those who turn out a small variety of products; but I do not by this mean that the successful mechanical engineer is one who takes a narrow view of his profession and its responsibilities. This is certainly very far from being the case. An engineer may manufacture but few machines or other products, and yet may be—and, if he is to be really successful, should be—a man of extensive general knowledge and of wide experience in the practice of his profession. But he must concentrate this knowledge and this expe-

rience and bring them all to bear on the work he has in hand, so as to produce that work at the lowest possible cost, and—what is even more important—of the highest possible quality. Experience shows clearly that mere lowness of price is not in itself an inducement to purchasers; and the maker of an engine of exceptional economy, or of a machine tool which excels its competitors in the quantity or quality of the work it turns out will never find difficulty in obtaining proportionately good prices for his productions.—Address of President William H. Maw, Institution of Mechanical Engineers.

Improved Pneumatic Riveter.

The half-tone, Fig. 1, shows the improved and up-to-date Allen pneumatic riveter, one of the pioneers of this class of tools and one which has found wide em-

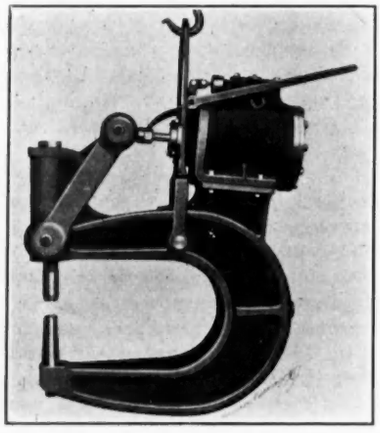


FIG. 1. IMPROVED PNEUMATIC RIVETER.

ployment. In this type of machine, perhaps more than in any other, the value of the steel casting is practically demonstrated, both in the strengthening of the machine and in simplifying and cheapening its construction, and the possibilities of its adaptation have of course been fully availed of. Fig. 2 shows the latest improvement of the machine, which is in securing adequate bearing and wearing surfaces where the great strains are encountered. The working movement of the riveting plunger is produced by the swinging of the two links *f* and the central link *e*, the final squeeze occurring when these are all in line. The links *f* are of course subjected to a tensile strain, while the central member *e* has an equal compression strain. None of this strain, it will be noticed, comes on the central pins of the various joints, as these are all purposely fitted loosely. The entire head *k* of the connecting rod bears against an accurately machined surface in the link *e*. Two large hubs are cast on the sides of the main yoke of the machine, and there are two similar hubs on the head of the compression member *e*, and all the riveting strain of the machine is taken by these hubs. A renewable steel collar is placed upon each hub of the yoke, and phosphor bronze bushings are used upon all the hubs. The side rods *f* are held in place by bolts tapped into the hubs of the yoke and into the central pin of the main joint, as shown. The bosses by which the machine is suspended are placed at the center of gravity, so that the machine may be used either vertically or horizontally or otherwise, and be balanced in either position. The machine is made by John F. Allen, Gerard avenue, New York.

Echoes From the Oil Country.

THE INQUISITIVE CUSTOMER.

We try to treat all of our customers with due consideration, overlooking any little peculiarities they may have. We learn generally to keep a straight face when laws of mechanics are laid down to us which are, to say the least, a little different from what the books teach; but once in a while one comes in who seems to strain our patience close to the breaking point. We had such a one the other day, and, while I don't encourage Sammy any in his pranks, I had to laugh in spite of myself. Fortunately for the discipline of the shop, Sammy didn't know I was a spectator, and I guess the customer is rather on the fence as to whether it was an accident or not.

You see, it was about this way: A man brought in one of those little, twisty pieces that don't seem to have any shape to get a good size from, and that just has to be forged up by the eye, and then filed and twisted and tried to its place until you get

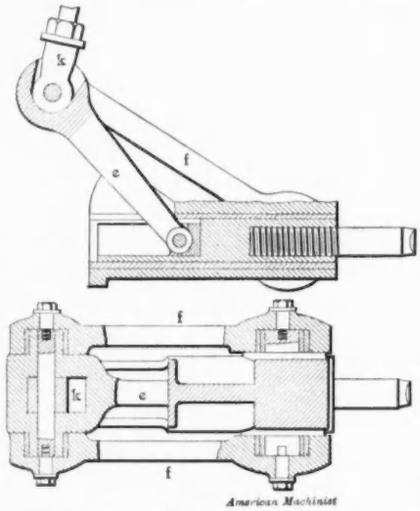


FIG. 2. SECTION OF CROSSHEAD JOINT OF RIVETER.

it to come right. It was a small affair that didn't weigh over 2 or 3 ounces. The original one had been brass, and we were replacing it with a steel forging. There were several prongs on it that had to stand in certain positions in relation to one another, and also to a tapped hole that connected this piece to the rest of the apparatus.

The job was forged out roughly and given to Sammy to fit up, the owner keeping it very close company. He took it to the vise and, getting out several files, started to file it up. Owing to its peculiar shapes, only a little work could be done without either moving it in the vise or changing files, and here the fun began. Sammy would reach for a file and find that his visitor had it and was making a very careful examination of it. He would lay the piece out of the vise for a minute to get a piece to go in between the prongs, and in reaching for the piece find it was being turned over in the visitor's hands, and would have to be asked for, and all the time the fellow's jaw was working like one of the automatic guns in which the firing of one charge gets ready and fires the next one, giving a continuous steam.

Between trying to keep track of the piece he was working on and the tools he was working with, trying to give polite answers to all sorts of questions on a great variety of subjects, and trying to see the connection between some of the general remarks thrown in as extras and the job on hand, Sammy was kept pretty busy; but being a whole-souled fellow, he found time to think of something to do as his share of trying to make things entertaining.

It was very easy to see that the handling of the things and the questions did not come from any deep motive, but were more a disease that needed a cure, and Sammy thought he would try the role of doctor.

After the piece was all drilled up and tapped he found that one of the prongs needed bending. It could have been bent cold, but he preferred taking it out to the blacksmith shop and having it warmed. He had left his visitor turning over some stuff on the bench when he went out, and was not followed, but found the man looking around for him when he returned. The piece was not red hot, and it was held on the end of a stick so as to look as if held in the hand, and was dropped on the bench in an off-hand manner while Sammy stepped to a cupboard, turning his back to it and the customer, who promptly reached forward and grasped it, and just as promptly let go again and began looking at his fingers, quickly putting his hand behind his back as Sammy turned from the cupboard. As soon as he could stop the cough that suddenly seized him, Sammy gravely screwed a rod into the piece, rapped the prong until it lined up right, dipped it into his wash pail, polished it up, and put it where it belonged, without a word from either side.

Not a thing more was touched, but Sammy had several violent coughing spells, caused by seeing his visitor making a side-long examination of his fingers whenever he thought he was unobserved. The blacksmith and his force seemed to be extra noisy, for some reason, and I thought it policy to keep out of sight of the men myself.

By the way, our blacksmith gave me a good illustration of how a man may be fooled sometimes. One winter evening I went into the blacksmith shop and told him to cut off a piece of iron as soon as he got the opportunity, either that evening or the first thing in the morning. The weather was very cold, going to 20 or 30 degrees below zero in the night, and the blacksmith shop wasn't any warmer, to speak of, than outside by morning. About half-past 7 in the morning I went out after the piece and saw it lying on the floor (ground). I stooped to pick it up, and just as I got hold of it and had it off the floor the blacksmith gave a yell, "Look out!" Of course I dropped it, and the blacksmith began laughing and said, "Is it hot or cold?" catching my other hand to keep me from feeling the one I had grabbed the iron with. I could not tell by the feeling of the hand, for sure, but thought it must be hot as that had a burning feeling; yet I judged it was cold from the fact of the question being asked.

It was cold and the blacksmith laid it in the fire for a bit to draw the frost out of it before I took it in.

How would you like to work in a place where heavy woolen stockings, boots and arctic overshoes failed to keep the feet warm, and the frost would stand up heavy on a machine not 10 feet from a "Volcano" heating stove as hot as soft coal would make it? The stove pipe of that stove would get filled with soot very often, and to clean it out we would take a tin cup full of water, throw it into the stove and slam the door shut and hold it with the poker. Sometimes it took the pipe off, and if the door was not caught, it was likely to fill the face of the chimney sweeper with dirt and perhaps take off a little hair. I have seen it raise the top of the stove and send the fire out through the ash box. A can of crude oil did not have as much effect in stirring things up. We used the oil to hurry the fire up when it was dull, but always used the water when the fire was large without much green coal.

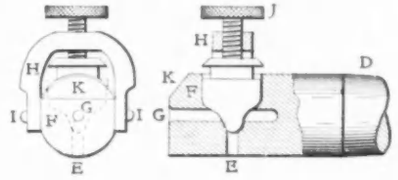
One has to be constantly on the alert for gas and oil here. I lost some hair from my arm once and the owner of the pump lost some of his whiskers and eyebrows by swinging a torch down into a gas pump. That pump had not been used for a month, and had set in the shop for a week, but it had enough condensed gasoline lying in some corner to make a slight explosion when we took the head off and went to examining the bore to see whether it needed reboring. That was a primitive, graphic illustration of the possibilities of a gas engine. W. OSBORNE.

Two Drill Jigs.

BY JOSEPH V. WOODWORTH.

In Figs. 1 and 2 respectively are shown two drill jigs of rather novel character suggestive of ways of drilling a large variety of different shaped pieces. Fig. 1 is used for drilling the hole *a* in the brass piece *A* used for a basin plug, a rubber washer being fastened abound the neck, the hole *a* being for the chain ring.

For this jig a piece of one-inch round machine steel was turned with a taper shank to fit the tail spindle of the speed lathe, and a hole was drilled through the body at *E*. The piece was then held in a two-jawed chuck, and this hole was enlarged and bored to the shape shown so that the piece *A* would just fit it. The jig was then put in its place in the tail spindle and the drill hole *G* was drilled. The swinging yoke *H* was got out by forging a piece of steel, machining it to the shape shown and fastening by pins *I* to two flat sides milled on the body of the jig, a knurled head screw *J* securing the work. A portion of the face of the jig was milled away at *K* for clearance for



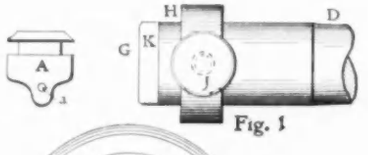


Fig. 1

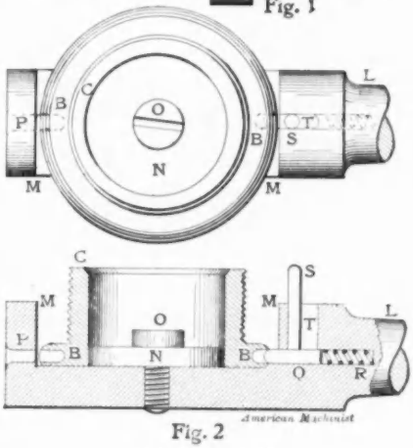


Fig. 2

TWO DRILL JIGS.

the yoke *H* to allow it to swing off and on freely.

When in use the jig was set in the tail spindle and the drill was held by a small chuck in the live spindle. The yoke *H* was swung downward and the work to be drilled was placed in the jig at *F* as shown. The yoke was then swung up and the fastening screw *J* tightened. The tailstock was then run out and the drill entering the hole *G* the hole *a* was drilled. The hole *E* through the body of the jig allows an easy escape for the dirt and chips.

In Fig. 2 we have another adaptation of this style of drill jig, although the construction is somewhat different. It is used for drilling the holes *B B* in the screw plugs *C*. These plugs were brass castings and were finished all over to the shape shown in section. The jig for the holes *B B* consisted of a piece of 1¼-inch round machine steel turned with a taper shank to fit the tailstock the same as the other. It was then put into the live spindle and a hole *P* drilled to *R* by using an extra long drill of the diameter required. The front of the hole *P* was nicely rounded with a hand tool to allow an easy entrance for the drill, when the jig was in use. The jig was transferred to the milling machine and a section was milled away at *M M* to the depth shown, so that the center of the flange of the work *C*, when in position, would be in line with the drill hole *P*. A machine-steel disk *N* was finished in diameter to fit the hole in the work *C*. A hole was let through the center of this disk and it was fastened by the screw *O* on the flat milled surface of the jig, central and in line with the drill hole *P*. The spring pin *Q* was made with a spiral spring *R* at the back and a handle at *S*, a clearance channel *T* being cut in, thus allowing the pin *Q* to be pulled back and the work released. When in use the work *C* was located on the jig by the disk *N*. The tail spindle was run out and the first hole *B* in the flange was drilled to the depth required. The work was then turned around the disk *N* until the hole drilled in the flange was opposite the locating pin *Q* which snapped into it by the tension of the spring *R*. The second hole in the flange was then drilled.

The two jigs here shown for use in the speed lathe are about the least expensive that could be devised for the drilling of the work shown, and it was surprising the amount of work that could be turned out with them. Jigs of this design and construction are very popular in the brass shops where the speed lathe is often adopted for work that is ordinarily done in the drill presses.

Mond Fuel Gas in Great Britain.

Consul James Boyle sends from Liverpool some account of an extensive proposed installation of Mond gas works in England. Leading manufacturers have a bill in Parliament to give authority to erect plants, lay mains, etc., to supply an area of 135 square miles. It is supposed that the scheme will be in operation within five years. Five generating stations are to be established, and from these the gas will be conveyed to the various manufacturers in the district for use in furnaces and gas engines, but not for illumination. Mond gas is a "producer gas," made from the cheapest class of small coal and dust, commonly called "bituminous slack." Dr. Mond discovered a process by which this cheap slack can be converted into a clean gaseous fuel in such a way that a very large proportion of the nitrogen of the coal is recovered (as ammonia) and converted into sulphate of ammonia, which is a very valuable manure and fertilizer.

Mond gas is not a lighting gas; it burns

with a pale-blue flame and has a much lower heating value than illuminating gas. It is a gaseous fuel, adapted for wholesale use as a heating and power agent, and the gas engines at Winnington, Cheshire, using Mond gas, hold the world's record for economy for long and continuous runs. An experimental open-hearth steel furnace has been worked, with excellent results, using Mond gas, and the gas is in daily use for glass melting, ore roasting, many kinds of furnace work, evaporating liquids, heating buildings, etc.

The volume of gas furnished from 1 ton of fuel fed into the producer varies from 140,000 to 160,000 cubic feet, according to the quality of the slack, and is sufficient to develop 2,000 indicated horse-power hours when utilized in a gas engine. The value of the sulphate of ammonia recovered from 1 ton of fuel is, at present prices, 8s. ($1.94), naked at the works. From this it appears that a considerably better economy is reached than in any steam engines, 1 horse-power being realized from about a pound of the cheapest and hitherto practically worthless fuel, in cheap engines of small size as well as in larger plants. The coal seems to pay for itself with the sulphate of ammonia and to give the gas for nothing.

Some Points of Experience in Making Twist Drills, Taps and Dies.

BY WOLFRA M. FOX.

A short time ago I had a special four-lip twist drill to make, and in looking for a cutter with which to do the job, a round convex cutter, of perhaps 2¾ inches diameter and whose face was of ¼ inch radius, was the only one available, and as the drill was to be 1⅞ inches diameter, the job didn't seem at all feasible. I had the blank turned up, however, and to groove it I geared up the universal head for the spiral for a twist drill of that diameter, 16.87 inch pitch, for mine, and used the cutter mentioned. But instead of setting the carriage at the angle called for, approximately 20 degrees in a spiral of that pitch, I gave it enough excess of angle to allow the cutter to cut a groove wider than itself, as shown in Figs. 1 and 2. Referring to Fig. 1, *a* represents the cutter arbor, *b* the blank operated upon, and *c* the cutter. The effect will be made clearer by a little study of Fig. 2, which is an end view of the blank and shows the profile of the cutter *c* to be approximately an ellipse *d e f g*. The groove milled is a portion *d e f* of that ellipse. These figures are not mathematically exact, but they serve to illustrate the point involved.

I have used the same scheme in milling where the diameter of the drill or tap, or rather the circumference, was such as gave too much or too little land for an exact number of teeth, using such cutters as were on hand. The result of this is represented in Fig. 3. The dotted curve represents the cut as it would be made with a narrow cutter under ordinary conditions; the full curve shows the effect of swinging the carriage at an angle. In this case I have supposed the cutter to require an angle of 25 degrees to mill the groove of the desired width, ignoring the extra angle called for by the spiral, which in this case was 20 degrees, throwing the carriage at an angle in all of 45 degrees. Had the carriage been swung about to the position represented by the dotted line, it would have required an angle of but 5 degrees, which 5 degrees, plus 20 degrees, would have produced the same effect as the 25 degrees without the spiral motion. My object in giving it 45 degrees instead of 5, which is also possible, was that the advancing portion of the cutter might terminate at the end of the lip with the least amount of travel, which is necessary in my case owing to the fact that I was obliged to come to a stop at very nearly the end of the lip. This will leave the lip backed as shown at *t*, which prevents chips collecting at the end of the groove in a pocket, as they might otherwise have done had the angle been such as to leave the material as shown by the dotted curve at *t*.

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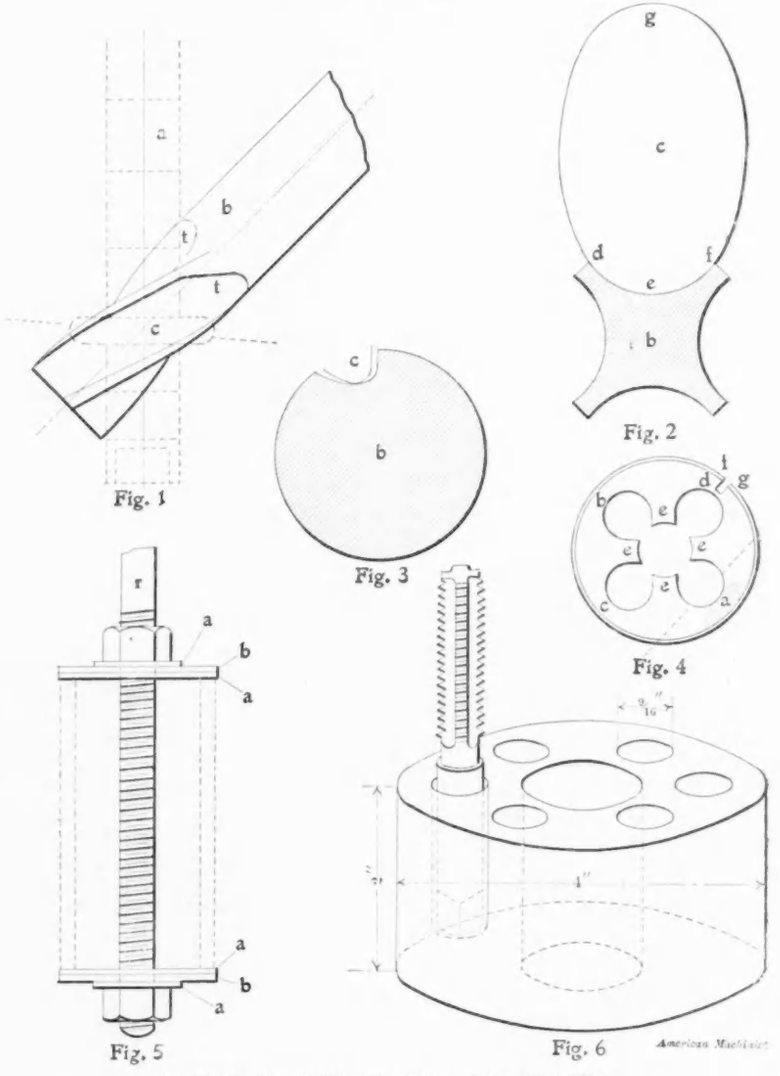
Very few shops are equipped with a machine for relieving taps, hobs, etc.; yet such a machine is needed as much in an ordinary shop making its own tools, as in a more pretentious concern making them as commercial articles. Where there is no machine for this kind of work, very good results may be obtained by returning the blank to the lathe, after the grooves have been milled, and, pulling the belt by hand, deepening the threads about .001 to .002 inch, beginning about 1-32 inch back from the front of the tooth, using the thread-tool stop to gage the depth. Of course it will be necessary to move the thread tool in and out for every thread so deepened, but I believe that the cutting qualities of the tool are so much improved by this operation that the toolmaker will be willing to suffer a little arm ache to secure them.

Taper your straight (?) taps so as to leave them largest in diameter at the cut-



MAKING AND TEMPERING DRILLS, TAPS AND DIES.

ting end, and always give them an even number of teeth. There are very few cases where an odd number of teeth is of any practical advantage.

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In making small round dies, as in Fig. 4, a very good way in tempering them in small, or even in large, lots will be found in the following scheme: Split your die as at *d*, after it has been drilled, marked, filed, etc., but don't carry the cut clear through. Leave about 1-32 inch of the material at *d*. Harden as usual and polish the sides. To draw: Have a red-hot lead bath. Immerse the die edgeways up to, say, the dotted lines shown in the figure. After being immersed a moment, remove for examination. If you have timed it properly, you will find that the part *a* has turned to a blue and about the shape indicated by the dark portion, while the points *c* are as yet uncolored. Treat *b* likewise, and in turn *c* and *d*. If done properly, there will be heat enough stored up in the outer portions of the die to gradually color the points *e*, which I allow a yellow or dark yellow, as the case demands. Check the tempering process by dropping a few liberal drops of lard oil upon these teeth. A little experience will teach one just about how much heat to impart to each portion of the die in order to have all the points *e* arrive at the same color together. The die may now be polished again, and, as a last operation, the material left at *d* can be removed by grinding with a thin emery wheel. The thickness of the wheel, about 1-16 inch, should be provided for in splitting at *d*, to allow the wheel to enter without pinching. The object in leaving the die solid at *d* is to hold the ends *f* and *g* firm while hardening, thus preventing warping, etc. The same idea may be carried out in making split bushings, etc., that are to be hardened with the least amount of warp.

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In hardening bushings, shell reamers, hobs, etc., use the device shown in Fig. 5, which consists of a piece of ordinary rod, *r*, threaded, say, an inch or so longer than the length of the piece to be hardened. Run a nut up the rod with washers as shown in the figure. The dotted lines represent the outlines of the piece of work to be hardened. *a a a a* are asbestos washers or packings cut out from fireproof sheeting or the like, *b b* common wrought-iron washers, the whole held together between the two nuts. Heat the whole thing to the proper heat and quench in water as usual. Closing the ends of a piece in this manner prevents an upward flow of water through the piece, and the consequent sudden chill, thereby avoiding to a great extent warping and cracking of the piece. Where the outside only of a piece is required to be hard, this method is an excellent one. The inside of a shell hardened in this manner will usually remain comparatively soft, unless it is quite thin, when it will harden clear through. I suppose that if it is required that the inside of a piece be hard and the outside soft, the article might be surrounded with clay as suggested by a contributor in another article published in the "American Machinist" a short time ago. This would prevent direct contact of water with the portion so covered, preventing a too sudden withdrawal of heat from that particular surface.

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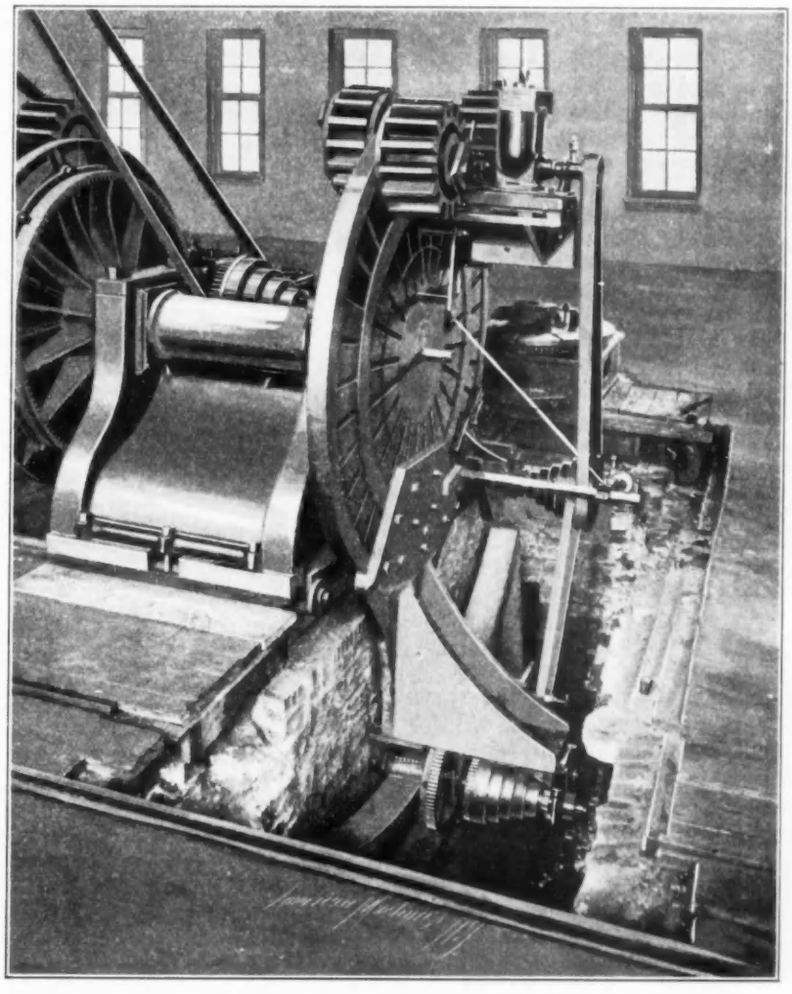
For tempering taps, I use a muffle shown in Fig. 6, which is, in my case, a piece of cast iron with 9-16 inch holes drilled into the face to a depth of about 1½ inches. I give the dimensions of mine, but these can, of course, be changed to suit individual requirements. The size shown admits of nearly all taps from ¼ inch diameter up to ½ inch diameter, being tempered. To use the thing, heat it to a good red heat. It can be left buried in the coals of the fire, or taken from it and stood on a brick; the holes, of course, must be clear of coals or ashes. Drop a tap into one of the holes of the muffle, shank first, follow with another in another hole in a minute or two. Continue this until there are a half dozen or so being heated at once. Now return to the first tap. This will soon begin to show color at the end of the groove, near the shank. As soon as a little purple appears, reverse the tap in the hole of muffle, and, holding it in the grip of a pair of tongs, keep moving it up and down a little, taking care not to let the end of the tap rest upon the bottom of the hole, as this would heat it too quickly at the end and give an uneven temper. When the desired color, which may be a yellow, has appeared, check by dropping some lard oil on the tap, as this will allow it to cool slowly, thereby toughening it. Repeat this with the other taps, and when a few holes are empty you may begin to refill them with new taps. A little experience will teach one just how much time to allow between the successive taps that are placed in the muffle, that there may be ample time to perform all these operations. Tempering in this manner allows the work to go on fairly rapid, and insures a tap that will possess some very good features. If properly done, the tap will be hard enough to cut almost any material that a tap is expected to cut, and will possess strength enough near the shank to resist breaking or twisting off at that point. I may mention that the heat stored up in the shank will slowly move toward



MILLING SADDLES OF LARGE RADIUS.

the cutting end, while that part is being heated, as explained, and by the time the cutting end has approached the required temper the purple near the shank will have moved about ¼ to 1-6 of its length, and I will also add that the taps, dies, etc., etc., are to be polished as usual before tempering.

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If there is anything in this article that is old or has been in use for years by some of the readers, I may add that I know of many more who never saw or heard of them, and very likely there are others outside of my circle of acquaintance. I therefore respectfully submit this for the benefit of such.

Milling Saddles of Large Radius.

Facts prove that ingenuity is not confined to Yankee land and that Pennsylvania mechanics sometimes improvise in a way to make the Yankee scratch the moss on his wooden nutmeg.

Not long ago a proposition sprang up over night and landed on the shoulders of Mr. M. K. Morris, general foreman of the machine shops of the Pennsylvania Steel Company's plant at Steelton, Pa. The problem was this: Six saddles of steel casting were made, having an internal radius of 12 feet. They had to be machined, and there were no visible means for doing it. The pit lathe was too small, but was the only apparent means of doing the work. Like a neuralgic pain in the head, this job was ever present without relief. A ray of hope came when, while walking through his shop, Mr. Morris was attracted by an Ingersoll milling cutter. He was not slow to combine the old pit lathe with the Ingersoll cutter to make the machine to do his work; and, by the way, the old lathe brings to light a firm name little known to the best informed men of the times, for it bears the nameplate of Bement, Colby & Dougherty, of Philadelphia.

Mr. Morris laid his plans and constructed a radial milling machine out of picked-up parts and scrap lying about the plant, as shown in the illustration, and did the work in six hours per saddle from start to finish. The feed was accomplished by reducing the countershaft speed. It would have required a lathe swinging 32 feet to bore the saddles. It is easy to equip a plant with tools if you have the money at your command, but it is another matter to find a man who can improvise when the occasion arises and do the work profitably to his employers. There is nothing that characterizes the foreman of a shop more than just these Yankee tricks, and the Pennsylvania Steel Company has the faculty of gathering together just such men. The cut is from a photograph taken of the device. If you want to see new things and meet hospitable men, go to Steelton. W. S. H.

Two Drill Jigs for Odd Shaped Castings.

BY WILLIAM DORAN.

The two jigs shown in two views each, in Figs. 3 and 4 respectively, were used for the rapid drilling of the holes in the castings, Figs. 1 and 2, and as they proved rapid and accurate producers, the design and construction of them may prove of interest to those having a number of holes to drill in odd-shaped castings.

The first jig, Fig. 3, for drilling the casting, Fig. 1, is of a very simple and inexpensive type, so constructed as to allow of the rapid locating and fastening of the work and the removal of the same when finished. The casting as drilled is shown in two views in Fig. 1, and has two holes *A B* drilled in each of the eight arms. Before being drilled the castings are chucked in the turret lathe, and the center hole *C* is bored and reamed to size and the hubs are faced.

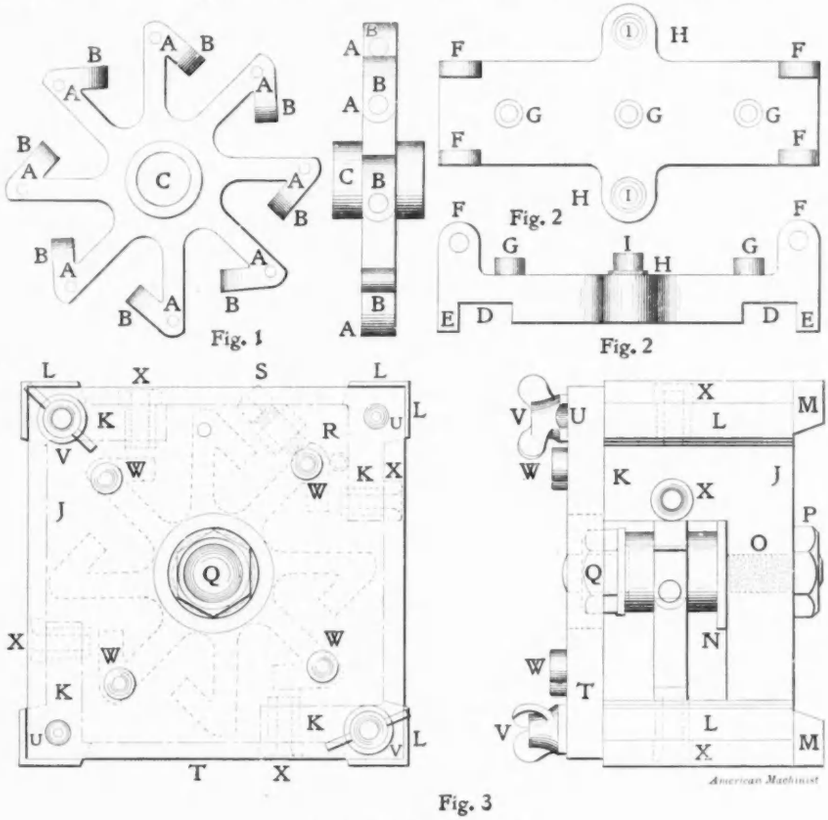


Fig. 3

TWO CASTINGS AND A JIG.

The jig, Fig. 3, consists of two castings, of which *J* is the body casting and *T* the lid. *J* has openings at all sides for the escape of the dirt and drillings. The legs *L*, on four sides, and those at *M M*, on the back, are finished and scraped, so as to be dead square with each other. The face of the body casting is also squared with the sides, so that the lid will rest squarely on it. Two dowel pins *U U* locate the lid, and the thumb nuts *V V* are for fastening it. A stud, of tool steel, which is threaded at both ends, and its largest diameter finished to fit snugly the center hole *C*, is let into the bottom of the body casting, as shown at *O*, and held rigidly in position by a nut *P* at the back. A large hole is bored in the center of the lid, so as to clear the nut *Q*. The sideway locating point is at *R*. It consists of a "Stubs" steel pin, which is hardened and driven into the body of the jig. The set-screw *S* is also hardened and let in through the projecting lug, and is used for forcing the work against the locating pin *R*.

The four bushings *X* are let in as shown, and the manner of locating and finishing the holes was as follows: The body casting was strapped to the table of the universal milling machine, and the center of each hole was located and the hole was finished in turn by the use of a Brown & Sharpe hight gage for locating, measuring from one side of the jig and from the miller table, and using a sharp end mill for finishing, first drilling the hole with a drill about 3-32 inch under size.

The four holes for the bushings *W* were located by the "button method," as described by Mr. Howe in the "American Machinist" a short time ago (and, by the way, this article by him was the means of convincing the Old Man that the button method was the only one to use for accomplishing accurate results in drill jigs; before this the methods in general use were—well, it is no use going into details; it was all luck when they came out right). After being located, the four

holes were drilled and finished to size by strapping the lid on the lathe face-plate and locating each button to run true by the use of an indicator.

When using the jig, the lid *T* was removed by unscrewing the thumb nuts *V*, and the casting to be drilled was located on the centering stud *O*, the faced hub of the work resting squarely on the finished boss *N*. One of the angular-faced projections of the work is then forced against the locating pin *R*, by tightening the set-screws *S*. The nut *Q* is then tightened, leaving the work located and fastened securely within the jig, as shown by the dotted lines in the plan view of the jig. The holes *B* in the projections are then drilled through the bushings *X*; that is, through every other one of the projections, by standing the jig on each of the four pairs of legs *L* in turn. The jig is then rested on the legs *M*, and four

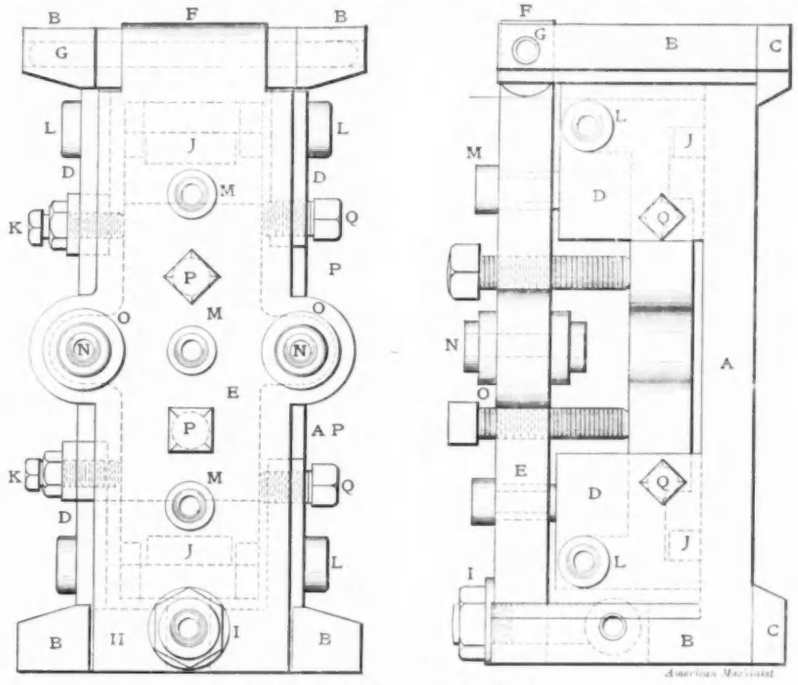


FIG. 4. JIG FOR DRILLING FIG. 2.

of the holes *A* are drilled through the bushings *W*. The lid of the jig is then removed, and the nut *Q* and the set-screw *S* loosened. The work is then moved and located so that the holes *A* and *B* in each of the four remaining projections may be drilled. The operations of locating and fastening the work and then of drilling the holes are repeated.

As can easily be seen, the design and construction of this jig is of the simplest possible character consistent with accurate and rapid production. Although it is necessary to locate the casting twice, thereby entailing two operations, the time consumed amounts to very little, and is fully compensated for when the simplicity and cheapness of the jig are considered, as in order to drill all the holes in one operation a far more complicated jig would have been necessary.

In Fig. 4 is shown a jig of a rather more elaborate and complicated design than the first. It is used for drilling the holes in the casting, Fig. 2, and finishing the hubs—that is, the three holes *G* and the hole through each of the lugs *F*, the hole through the hubs at *I* and the finishing of the hubs at *H*. As shown in the two views of the jig, Fig. 4, the work is located at three points: at each end by the finished projections or lugs *J*, locating within the parts *D*, which are milled to size in a preceding operation. The work is located sideways against the two adjustable stops *K* by tightening the two set-screws *Q* against the work. The lid *E* of the jig is hinged within the body casting at *F* by the pin *G*. Legs are cast on two sides and on the bottom of the body casting, as shown at *B* and *C* respectively. The four bushings *L* are for drilling the holes through the lugs *F*, and those at *M*, in the lid, for drilling the three holes *G*. The method used for fastening the lid while the work is being drilled is by means of a swinging stud and a nut and washer *I*, the stud being hinged to swing free in the body casting at *H*, a slot being let in it and in the lid for that purpose. Two set-screws *P* are let into the lid for locating and fastening the work within the jig.

The two large bushings *O*, for use when finishing the hubs, are permanently located within the lid, while those for drilling the hole *I* in the hubs are inserted within them when in use. When using the jig the work is located and fastened within the jig by the set-screws *Q* and *P*, and all the holes are then drilled. The two bushings *N* are then removed, and the hubs are faced and reduced to size. The fastening set-screws are then released, the swinging stud *I* is thrown back and the lid raised, after which the work is removed.

All the various parts of both these jigs, including the castings, are made sufficiently heavy and strong to withstand all strain to which they may be subjected when in use. The manner of locating the work is such as to be positive, and without the possibility of shifting during the operation of the tools. The means and points chosen for the fastening of the work within the jigs are such as to be rapid to manipulate, and such as to in no way interfere with the drilling; and, lastly, the design and construction of both jigs is such as to dispense with all unnecessary parts and labor.

Letters from Practical Men

Casting a Large Anvil in Russia.

Editor American Machinist:

In the northeastern part of Russia, on the banks of the River Kama, is situated the town of Perm, at which place the Russian Government has located a large iron and steel plant for the production of heavy cannon. In the year 1870 it was found, owing to the fact that larger and heavier arms were needed, that the 15-ton hammer then in use was too light, and it was deemed necessary to install a 100-ton hammer. To withstand the force of this hammer, it was decided to cast an anvil block of corresponding hight and size, and one of 500 tons was decided upon.

Before molding the block the ground was carefully examined, and after some search a suitable place was found. After digging through various strata of sand and clay, they came upon a stratum of slate which was found capable of withstanding 700 pounds to the square inch. A pit was sunk in the slate to a depth of 7 or 8 feet, and the foundation of the mold was begun. At the bottom of the pit two layers of heavy timbers were placed crossed. On this three layers of heavy cut stone were laid in cement, each stone weighing from 12 to 15 tons. This process of timber and stone was repeated twice. The whole was then covered with a double course of heavy timber crossed, and over this pit was erected an iron building, and the process of molding the block was begun.

Ordinarily, the curbing of a mold is one of the last things done; but in this case it was the first thing prepared. Heavy I-beams were placed in a vertical position around the pit, and to these were bolted two plates, making a large box without top or bottom, and in this frame the mold was made. The bottom of the mold was laid with four courses of brick, and the rest of the mold correspondingly strong, built up solid against the iron framework. The dimensions of the casting were: The base of the block, 16 feet 6 inches square, to a hight of 5 feet, from which point it was 9 feet 8 inches square and 9 feet high,

making it in all 14 feet high. These measurements give us 3,804,288 cubic inches, which multiplied by .2602 gives us about 496 tons, irrespective of trunnions and other projections.

The block was cast upside down, to secure a solid and perfect face, and provision had to be made to turn the mass over; consequently two large trunnions were cast on the side. I have not the data giving the size of them, but they must have been very heavy to stand the strain incident to turning the casting over. The trunnions were also used as gates or inlets for the molten metal.

While the mold was being made, fourteen Mackenzie cupolas were erected, and, to furnish air for these, three blowing engines with cylinders of 72, 78 and 108 inches diameter, making from 21 to 28 revolutions per minute. It required 127 tons of coal, and over 800 tons of pig iron were charged into the furnaces. The blast from the engines was turned on successively, and one hour after the blast was on the first tap was made. This occurred at 4 o'clock A. M., and at 3 P. M. 900,000 pounds of iron had been poured into the mold and had reached a hight of 10 feet. At 7.30 A. M. the next day the operation was complete. I might add that the cupolas were cleaned three times during the heat. Forty-eight hours after the cast a slight crust began to show itself. In sixty days it was hot enough to melt lead. According to trials made, the heat in the casting diminished first at the rate of 72 degrees per day. The difficult task of turning the mass was accomplished in forty-eight hours, two large steam engines being used in the operation. The entire cost of the job was $49,000.

F. B. SHAFFER.

Turning Elliptical Tapers.

Editor American Machinist:

A short time ago I was asked to make a number of punches and dies for the use of manufacturing jewelers in forming the gold settings for oval stones. It was rather an odd job, and I have thought a description of the device used to turn out the work would prove interesting to many of your readers, and possibly afford suggestions that might, in future, be of use to some.

I send herewith a drawing showing views of the die block, one of the two punches and the fixture for turning the points of the latter.

Fig. 1 shows the die block, Fig. 2 a punch, Fig. 3 a plan of the turning fixture and Fig. 4 an elevation of the same.

The die block was made of machinery steel and case hardened. It had seven oval holes the sides of which tapered to a point at the bottom, four being of one taper, and three of another more abrupt. The ellipse at the top of the larger holes had a major axis of 7/8 inch and a minor axis of 5/8 inch. The two punches were of the same form of ellipse, but of different tapers and each fitted its corresponding row of holes. These punches were made from 7/8-inch round cold-rolled shafting, and case hardened.

Referring to the views of the turning fixture *A* is the tool carriage of the lathe, *B* the base plate of the fixture which was secured to the carriage by bolts. *C* is a movable plate free to turn on the center *D* and carrying arm *G* with roller *H* which is made to bear upon the surface of the cam *J* by the tension of the spring *I*. The cam *J* was screwed on the spindle of the lathe and was made with a spring collet of proper size to hold the stock. *F* is the cutting tool mounted on block *E*. By means of the slots and cap screws considerable latitude for adjustment is afforded. *K* shows a punch in position with the point partly finished.

A hole was drilled in *B* back of the spring stud in *C*, in which a pin was inserted when it was desired to change the stock in the chuck. The pin being inserted and J partly rotated, *H* stood clear of *J* and the carriage was then run back so as to give free access to the chuck.

It will be noticed that the line of the cutting edge of *F* cuts the center *D* upon which *C* partially rotates. The stock being placed in the chuck, the carriage is moved up until *H* bears upon *J*. The pin mentioned above is then removed, the lathe started and the carriage fed forward. The cutting edge of *F* at *D* remains always

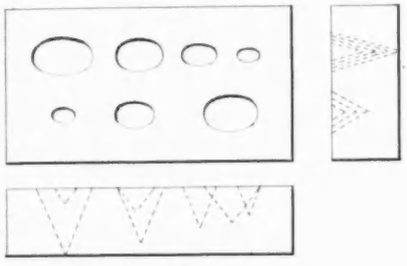


Fig. 1

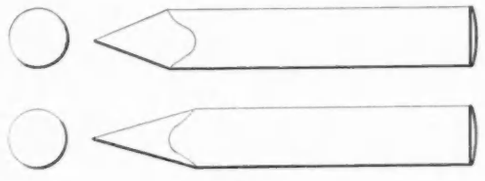


Fig. 2

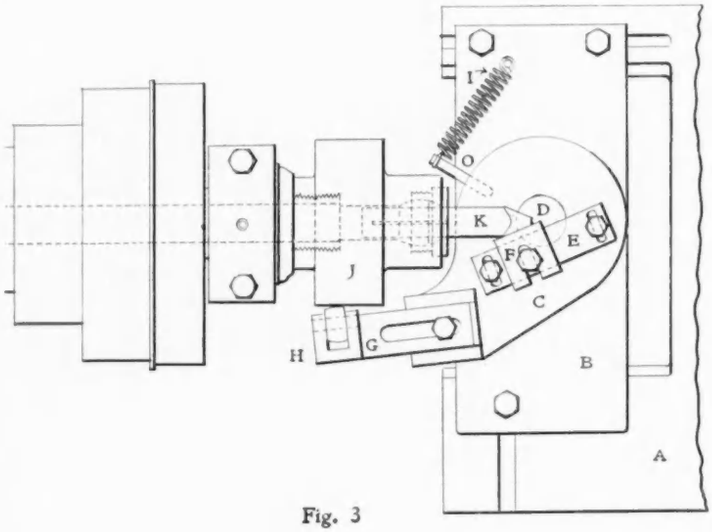


Fig. 3

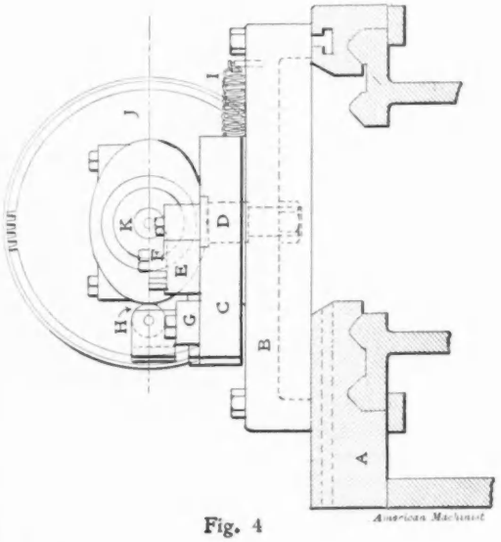


Fig. 4

A RIG FOR TURNING ELLIPTICAL TAPERS.

in the same position, but every other point of the cutting edge moves forward and back twice in each revolution of the spindle, the distance moved varying regularly between *D* and the left-hand side of *F*. When the carriage has been fed forward until point *D* reaches the end of the stock the punch is completed.

The drawing shows the fixture set for the longer taper. For the shorter taper the arm *G* was shortened and the knife *F* readjusted. The working of the device was entirely satisfactory, the product being very accurate and finished in shorter time than I had expected. The holes in the dies were worked out by drilling and counterboring as far as possible and the elliptical form then given by heating and the use of a drop hammer. Seven points of tool steel were turned in the fixture, hardened and set in a punch holder and these points were dropped into the heated block. This method we did not find entirely satisfactory. The forging altered the shape of the blocks and left a scale in the holes so that it took considerable labor to finish them properly. The next time we make them I shall either bore or mill the holes. J. A. WEBSTER.

A Blanking, Drawing and Hole Cutting Die with Positive Knockout.

Editor American Machinist:

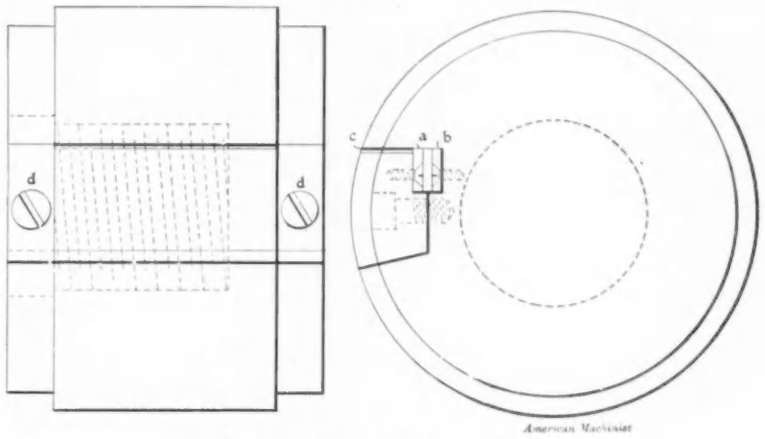
In the sketch is seen a somewhat novel blanking, drawing and hole-cutting die for producing in one operation a bracket made of IX tin. Fig. 1 shows the shape with dimensions of the bracket produced.

Fig. 2 is a section at *H*, in Fig. 3, through the punch, the new and original feature of this being the way in which the positive knockout is arranged. The central punch *B*, which is made of tool steel, is held in position by the hardened tool-steel key *C*, the knockout or stripper *D* being bored to a working fit to receive the central punch *B*, and turned to fit nicely at *E* to guide the same, but a loose fit at *F*, assuring a free working stripper or knockout. The key *C* is a driving fit in the stem of the punch, and free in the slot of the center punch *B* and stripper or knockout *D*. The slot in *D* is made long enough to permit its descent to the face of the punch. On the upward stroke the ascent is continual until the knockout lever is struck.

These brackets were to be made of different hights, from ¼ to 1⅛ inches, so it was necessary to leave the center punch *B*, as seen in the sketch, long enough to punch the lowest bracket.

To all practical die-makers it is well known that a spring in any die or punch is objectionable—that is, if there is any positive movement known that can be attached and especially in a combination where there is a long draw and no room for springs. Springs are like most die-makers: they are not to be depended upon. Another objectionable feature of a spring in this case was that it would bend the blank or the three legs *i i i*, Fig. 1, if the spring was strong enough to extract the blank, and should the spring fail to act and the operator not see it, there might be two blanks in the punch.

Fig. 3 is a plan of the die laid out to leave as little scrap as possible. Fig. 4 is a front elvation of the die.



COVERING A ROLL WITH EMERY CLOTH.

The spring rubber *J* was attached to a tube instead of a rod, to allow the scrap of the center hole to pass through. It was necessary in this case to use a long rubber. It will be found generally that better results can be had by using short lengths of rubber for a spring than by one long piece, as each piece expands independently of the other. JACK MARKS.

An Emery Cloth Roll.

Editor American Machinist:

I should judge the sandpaper rolls described by Mr. Richardson on page 368 to be very efficient for the purpose he specifies, and I send sketch of rolls used by me for several years and which I have found to be very convenient and useful. The material of the roll is cast iron and this is covered with emery cloth. It may be made, like the sketch, to screw on the

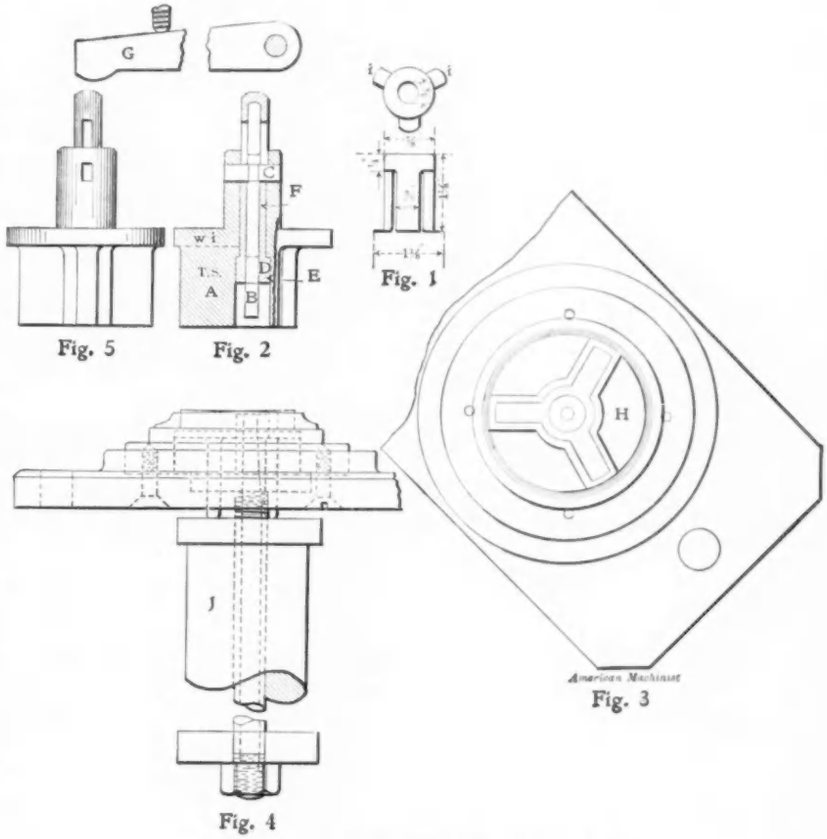


Fig. 5 Fig. 2 Fig. 1 Fig. 4 Fig. 3

BLANKING, DRAWING AND HOLE CUTTING DIE.

lathe spindle, or with taper shank, or on a mandrel on the centers. The point to which I wish to call attention is the method of securing the emery cloth, by which a practically unbroken surface is obtained and the emery cloth is drawn tightly to the roll. Referring to the sketch, *a* and *b* are steel strips, one of which is fastened to the roll and the other to the block by the screws shown. The ends of the cloth being inserted under these strips and the screws set down, it is held very securely with no danger of slipping, the opening *c* being made wide enough to admit two thicknesses of cloth. The ends of the cloth being secured, the screws *d* are set down, drawing the block down, while the inclined side draws it forward, thus exerting a powerful tension on the cloth, which is drawn tightly to the roll, making an excellent surface.

I also use a wooden face-plate with a cast-iron hub to screw on the spindle, the wood being covered with emery cloth, which is turned over the edge of the plate and tacked on the back. It is surprising to find what a number of jobs these tools can be used on, and once used a man wonders how he ever got along without them.

NEEDLE.

That Check Nut Again.

Editor American Machinist:

Check nuts have been plentiful in your columns recently, but, if you will allow a few words more, I would say that the Westinghouse Air Brake Company are using on the piston rods of their 9½-inch air pump a check nut having one face recessed so as to receive a conical shaped projection on the inner face of the main nut, as shown in Fig. 1.

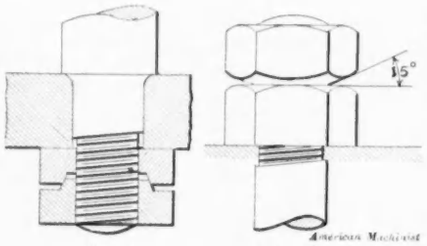


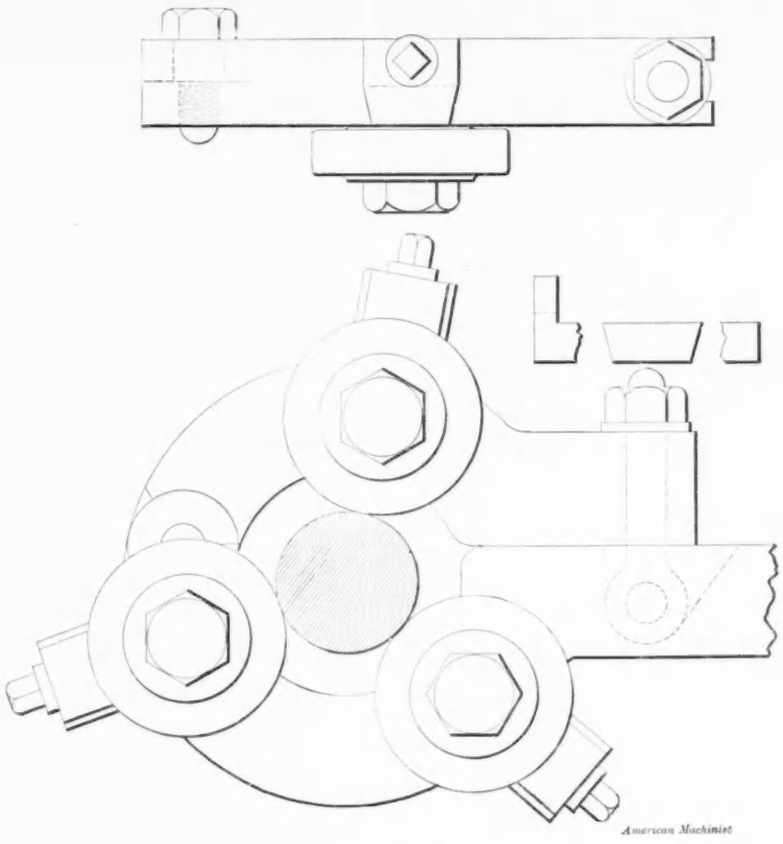
Fig. 1 Fig. 2

TWO NUT CHECKING DEVICES.

This projection acting as a wedge has a tendency to make the nut grip the thread on the piston rod more firmly than would be expected of the plain check nut.

I recently came across several check nuts with the face of contact beveled at an angle of about fifteen degrees, as shown at Fig. 2, instead of being flat. I do not know whether this was by design or whether a careless boy was employed in facing the nuts. At any rate, I asked myself the question: "Why does not that help the check nut check?"

J. H. MAYSILLES.



A THREE-ROLL PLANISHER.

A Three-Roller Planisher for Lathe Work.

Editor American Machinist:

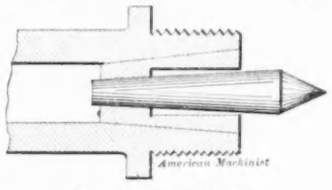
I noticed a planisher or roller for journals, spindles, etc., on page 389, and I venture to submit a three-roller planisher which I made some time ago and which has been in constant use and has proven highly satisfactory. As will be seen from the sketch, it is adjustable from ½ inch to 2¾ inches and can of course be made larger and heavier, if desirable. The use of three rollers has several good points. It removes practically all strain from the shaft being rolled, which is considerable, especially if of any length, and if of small diameter it is simply impossible to do the job with one roller. It also removes the strain from the centers and the tendency to wear the dead-center on one side. When using it, it is best to adjust top roller so that the top part of the frame stands open a little and then adjust the pressure with the nut on the swing bolt. The shank can be made any width to suit the tool-post. It is best to make all the bolts and screws of steel and case-harden. The slides are made a nice fit and bolts carrying the rolls left just long enough to project through and pinch on the bottom of the way for the slide at the same time that it must bear on the face of the slides. When adjusting for the size of the work these bolts are slackened. This tool, if properly made, will certainly give satisfaction and must certainly planish a journal much faster than a single roll.

P. C. R.

Nobody Did It.

Editor American Machinist:

I lately saw in a railroad paper an article headed "Pooling Increases Hot Boxes." "Pooling" meant sending out any engineer on any engine, a system meant to increase the monthly mileage. "Pooling" is no better in the machine shop. In looking over a shop a while ago I noticed that a machinist when tired of his machine, grabbed up his tool board and settled down on any other he found idle. A young machinist was complaining



THE RUINED BUSHING.

to me of the detestable practice. He said he one morning took a lathe where he had several chuck jobs to do, and after they were off his hands he had a piece to turn on the centers. He started a good cut to rough off, and a terrible chatter arose at once. He yanked out the tool and looked the lathe over, but found nothing out of the way. The foreman was standing near and the job was a rusher. By light cuts and a wholesale use of the file the job was at last finished. Then the lathe was gone over in detail, and everything seemed to be O. K., and the gentleman was per-

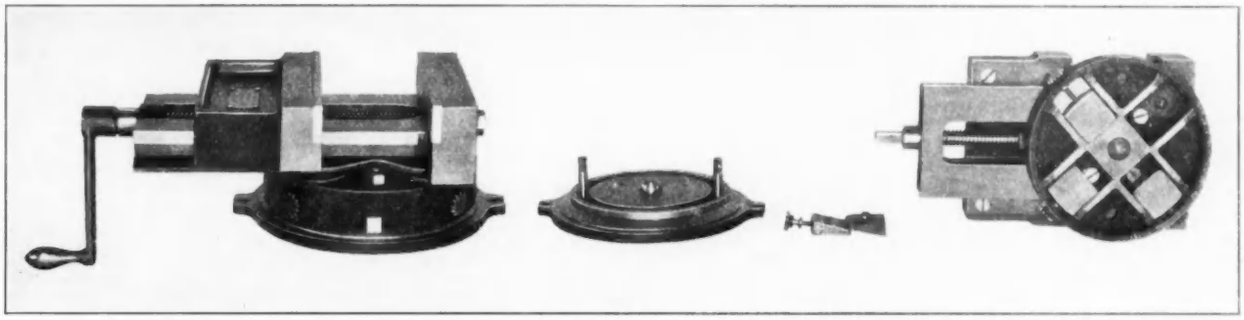


FIG. 1. VISE COMPLETE WITH TILTING BASE.

FIG. 2. UNDERNEATH VIEW OF TILTING BASE, WITH DETAILS.

plexed. He finally rapped out the live center bush with the center in it—it was a hollow spindle lathe—and that looked all right, like everything else. But when he knocked the center out of the bush the sketch shows what he found. "By the great horn spoon!" was all he said.

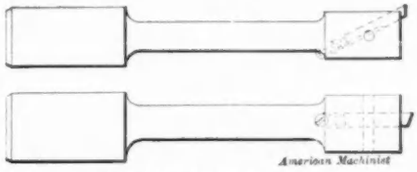
FRANK RATTEK.

[We permit our correspondent to tell his story for what it is worth, but we are unable to imagine where he found the shop where this indiscriminate and irresponsible use of tools was permitted, and we cannot believe any foreman of the present generation would allow it. We knew something of such a "system" "before the war."—Ed.]

A Boring Tool for Brass.

Editor American Machinist:

If anyone has small brass bushes to bore, and has had trouble with squeaking, sticking, four-lip drills, or such tools, he



TOOL FOR BORING BRASS.

will be glad to have his attention drawn to something which will cure all his troubles along this line. It is a tool with a shank made to fit in the turret of the chucking lathe, or whatever desired, and on the other end a hardened pilot in which a cutter is inserted at an angle as shown, so that the cutting edge is just ahead of the pilot. A set-screw is behind the cutter for adjustment, and the cutter is held from turning by a taper pin flattened on one side, which bears against a flat on the cutter. The holes in the bushes are cored, and a short drill should be used in starting. Bushings of any length may be bored with the tool, as the pilot keeps it cutting true with the hole as first started. There is nothing new about this, but used in the connection stated, it has been a great time-saver.

R. E. BLAIR.

A Tilting Attachment for Shaper, Planer and Milling Machine Vises.

Editor American Machinist:

I enclose photographs and blueprint of a tilting base for shaper vises which I have applied to a Steptoe vise, with great satisfaction. I find it especially useful for planing metal patterns for commutator bars and for shaping the clearance on dies, using a goose-neck tool. It is also useful where dead parallelism is required in a piece, as the springing of the chuck jaws and lifting of the work, as well as any lack of truth in the shaper knee, can be corrected.

Fig. 1 shows a vise complete with the tilting attachment, and Fig. 2 shows an underneath view with the vise lifted off the base-plate as well as the base-plate and wedges separately. Fig. 3 is a section and shows the wedges in place, together with the round-top central stud. The tilting cap was at first bolted down to the base by two bolts in a circular T-slot in the base, seen most clearly in Fig. 2. The nuts for these bolts are seen in Fig. 1. I found these to be somewhat unsatisfactory, and have now put a single central bolt down through the spring and round-top stud. This bolt has a ball nut at its top end sunk in the tilting cap, the bolt going down through the shaper table, where it is tightened by a fixed handle. This bolt does not disturb the adjustment when tightened.

For work in which the tilting adjustment is not required the vise may be quickly removed and placed on the regular base as it is of course much more rigidly supported in this way.

The attachment gives an adjustment up to 3/8 inch per foot.

B. LACHMANN.

Chicago.

Cutting Bevel Gear Teeth on the Band Saw.

Editor American Machinist:

I have read with much interest the articles on patternmaking contributed by readers of the "American Machinist" describing their methods of making gear patterns, and have frequently felt a desire to communicate my own. Finally the article by "Old Bob" in your issue No. 18 has given me the needed impetus.

Conducting a jobbing pattern shop in

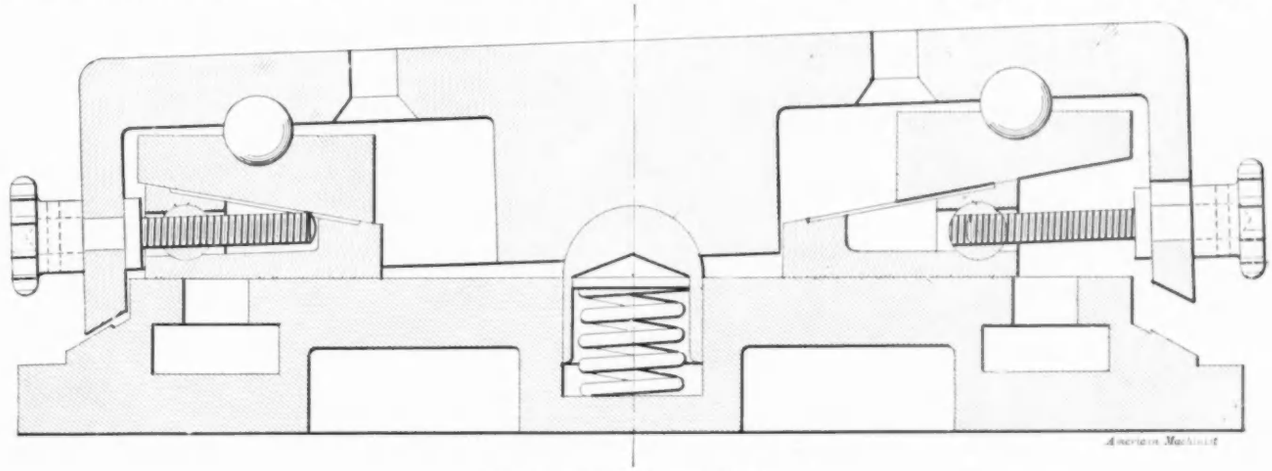


FIG. 3. SECTION OF TILTING BASE.

the vicinity of New York city for twenty years naturally sharpens the wits and leads to short cuts in doing what is usually a long job. I perfectly agree with "Old Bob" that attaching teeth that have been shaped beforehand is a very incorrect way of making a gear pattern, and that laying out one end of the blank and tilting the band-saw table for draft is a much more accurate method, if performed by a person who is practiced in close sawing.

For the past twelve years or more I

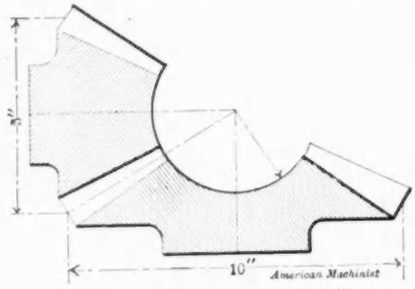


FIG. 1. GEAR BLANKS WITH SPHERICAL CENTERS.

have cut bevel gear teeth on the band saw, and have yet to see the first one returned for alterations. The method is so simple that I am surprised that it has not become more general. In this article I will endeavor to describe it so that any pattern-maker may understand and practice it. For example, take a bevel wheel 10 inches diameter meshing with a pinion of 5 inches as shown in Fig. 1. Turn the inside of the blanks spherical as shown and lay out the large end of the teeth only; next, turn such portion of a ball or sphere as is necessary to fit the spherical portion of the blanks, striking a fine center on same

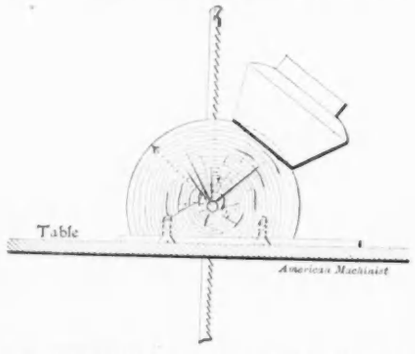


FIG. 2. SAWING THE TEETH ON A SPHERICAL SUPPORT.

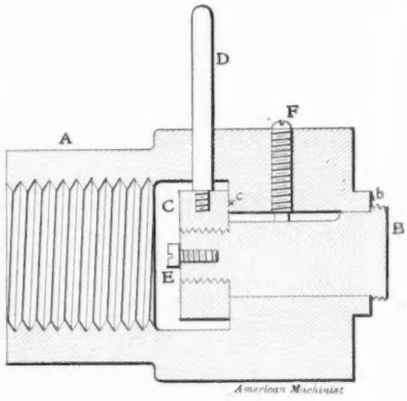
before taking off of the face-plate. Attach the flattened portion of this ball to a piece of board of parallel thickness. Lay this on the band-saw table set square with the saw blade and cut to the exact center of the ball, one side of the cut just touching the center. Place the hollow side of the gear on the sphere, as shown in Fig. 2, cutting only the side of the tooth next to the line of the saw cut passing through the center. After cutting all the teeth of both blanks on one side, move the ball the thickness of the saw cut so that the other edge of cut passes through the center and proceed as before. The board upon which the ball is fastened may be secured to the table by hand-screws or any other method found convenient. A narrow saw with not too much set should be used and after cleaning the rim between the roots of the teeth they may be sandpapered, no trimming being necessary. For small gears cut from the solid end wood, for large ones glue on blocks for the teeth. If it be found inexpedient to turn the gears hollow, a temporary block may be fastened to the inside to fit the spherical block.

S. H. ORTWAY.

A Slip Center Chuck.

Editor American Machinist:

On page 148 appeared an article describing a lathe chuck for finishing threaded caps which was somewhat similar to one I used some years ago in an Eastern shop. I cannot recall ever having seen it described in print, so I thought it might be interesting to some of your readers.



A SLIP CENTER CHUCK.

In the accompanying sketch *A* is the body of the chuck, which screws onto the lathe or turret machine spindle. *B* is a plug free to slide but not to turn, the screw *F* acting as a spline. The outer end of *B* is threaded to fit the cap to be turned; the inner end has a rather coarse left-hand thread. The nut *C* is put in from the back. The handle *D* is then screwed in through a long circular slot in body *A*, which allows the nut *C* to have some rotary movement to and fro. *E* holds a wire spring, not shown, which reaches up over the nut and hooks against the handle *D*, and pulls it always towards the back end of the slot, and the stud *B* is then up tight against shoulder *b*.

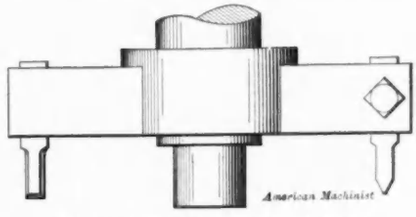
The cap to be turned is screwed on *B*, and when ready to be removed the handle *D* is drawn forward, which moves nut *C* away from shoulder *c* and makes *B* free to slide forward, when the cap is loosened and can be unscrewed with the fingers. When the handle is released, the spring will throw it back against the stop, and the chuck is ready for use. This device insures dead accuracy, and it can be operated very quickly. It was sometimes necessary to put caps back again, but they were always true, because they depended on a true shoulder.

NEMO.

Cutting Grooves in Copper.

Editor American Machinist:

There are few of us, I think, who, going to work in a new shop for the first time, do not more or less secretly hope the first job will be an easy one until accustomed to our surroundings. I have a very vivid recollection of the job I found myself up against when I first went to



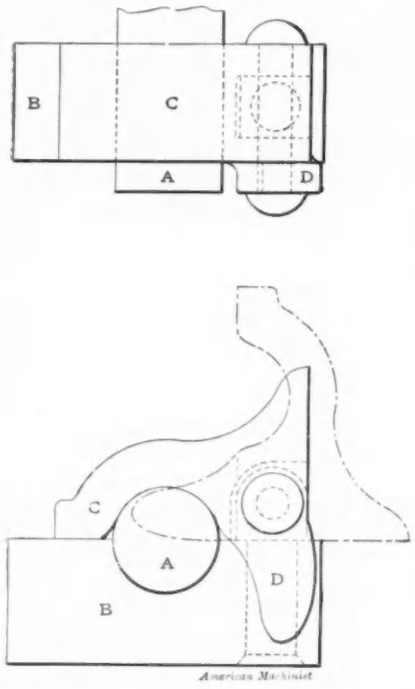
FOR CUTTING OUT COPPER DISKS.

work in one of Uncle Sam's arsenals. It turned out to be a job fought shy of by the initiated, and one that the foreman turned over to a man with mixed feelings of guilt and pity in his heart, and then avoided him for the next week. I was shown a pile of copper plates ⅞ inch thick and 16 inches square, from which were to be cut gasket rings about 14 inches inside and 15½ inches outside diameter. These rings are inserted in the breech ring of a 12-inch breech-loading rifle, where it screws up against the the inner tube. The plates were to be strapped to the lathe face-plate and the rings cut out with a parting tool. It looked "easy," but when the whistle blew four hours later and there were only two rings cut out and the end of a broken parting tool projecting from a third, I could have put my finger on a very disconsolate young machinist who expected his career with the government was at an end, though that was the least of his troubles. In spite of everything I could do, the tool would without warning suddenly load up and snap off or plow wicked looking furrows on either side of the slot for a few inches before bringing the machine to a standstill.

After dinner I hunted up the foreman, only to find I was making the usual headway. He told me some of the men thought the tool worked better with turpentine than oil and that others preferred milk. Both of these suggestions I followed religiously, experimenting as well with various amounts of rake and clearance to the limit of human endurance. The preference for milk I could understand, as it involved a trip to the "canteen," but, while turpentine is a very effective means of salvation in scraping steel, its advantages are in reverse ratio when applied to a tool slotting through copper. I soon convinced myself that no single tool, no matter what

its outline, would go through that copper without "loading," and that the kind of lubricant made as little difference. "No single tool." That seemed a clew to something better, and after a little more thought and tool dressing, which latter had been the major part of the job so far, I produced the winning combination.

The trouble had seemed to be caused by the effort of the chip to expand at the point of the tool, which tended to extend the cutting action to the sides of the slot, where the tearing rapidly spread until the tool was solidly blocked. I set two tools in the tool-post, one above the other, the bottom one being a regulation parting



AUTOMATIC DUST CAP FOR CORE BAR BEARINGS.

tool, the top one a thread tool blunted to one-third the width of the parting tool and set to cut 1-32 inch in advance of it. The way those tools walked through that copper, sending out three long, smooth chips, would make your heart glad. After that thirty-five minutes was all I needed to cut out the ring, and I asked no better fun.

Since then I have used the combination on many kinds of work and found it a great time-saver, especially on the cutting-off machine and on such work as boring out the solid ends of connecting rods on the drill press and boring mill, worked in a holder as per sketch. "MINNESOTA."

A Handy Cap, and A Handicap.

Editor American Machinist:

In making cores for cast-iron pipes, we, like some dirty politicians, throw mud, and this mud contains sand, gravel, etc., and in spite of the greatest care some of it will get into the bearings and cause the gudgeons and bearings to wear very rapidly; and when they are badly worn, the cores will in consequence be more or less out of round, and otherwise untrue, which finally brings us into clash with the inspector, who condemns the pipes that are otherwise good and sound, so that any arrangement that will obviate even partially this little trouble, among the many that bump up against the foundryman, will be gladly accepted with thanks. I present herewith our handy cap, hoping it may help some fellow craftsmen who throw mud for a living.

Calling the various parts by our shop names, hoping they may be readily translated into other shop nomenclature, in the sketch *A* is the gudgeon, *B* the brass or bearing, *C* the handy cap, and *D* a tongue of the cap for closing it. In operation, the gudgeon *A* revolves in the position shown by the full lines, until the core has been turned, when the hoisting hooks are applied, which raises the core, and of course the gudgeons *A* at either end of the spindle, vertically, raising the caps *C* with them and leaving them in the positions shown by the dotted lines, with the tongue D covering the depression or bearing space in the brass *B*, so that when the spindle for another core is lowered into place, the gudgeons come in contact with said tongue *D*, causing the cap *C* to fall into position for operation as before, keeping out some grit at least.

The "handicap" is in about this way: For the last ten years we have all held free intercourse with the heads of the various departments of our shop. Whenever we started out to get up a new machine, jig or fixture, we held consultations and asked ideas and opinions of all who were interested, and after the drawings were made, they (the foremen, etc.) were called upon to sign their names under the word "approved." But lately an edict has gone out. Our amicable régime has been assailed. We look now at each other over a cold shoulder. The edict is something like this: "To all ye foremen and shop bosses, hark ye. We want none of your ideas. We have ye mechanic, draftsman and patternmaker; behold! they know it all." And we are handicapped.

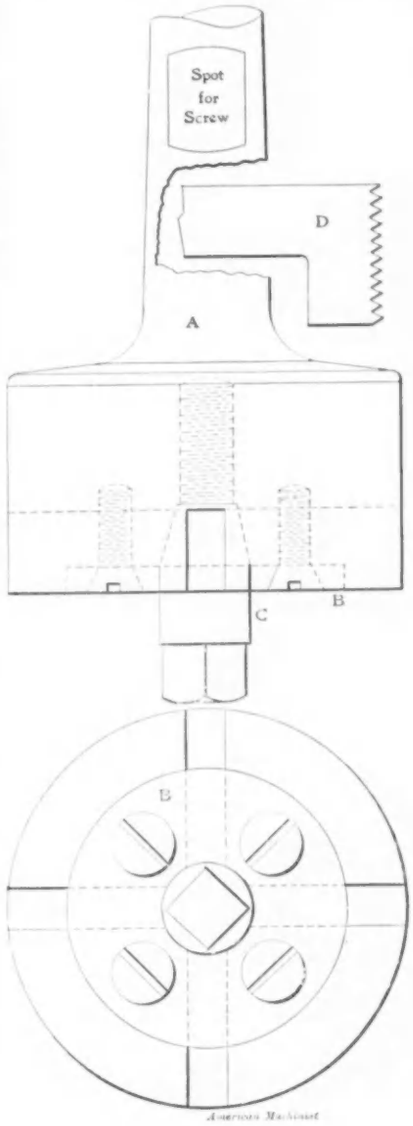
BRUNT.

An Adjustable Tap.

Editor American Machinist:

I send you sketch of an adjustable tap which I designed, and which is in successful use every day. The body *A* is made of machinery steel and fitted to the drill spindle. A recess is bored in the bottom face, ¼ inch deep, for plate *B*, and four cross slots are cut, ⅜ inch wide and ¾ inch deep. The head is then drilled in the center and tapped to fit the adjusting screw *C*. The head is bored out about ¼ inch below the chaser slots the size of the body of this adjusting screw. Tool-steel plate *B* is then turned to fit the recess in the head and bored to fit the body of the adjusting screw *C*. The chasers *D* are plain pieces of tool steel planed as shown in the sketch.

In setting up this tap, put the chasers in the slots, then put the plate on, and put the adjusting screw in place, as shown. Now press the chasers in against the adjusting screw and screw the plate down on the chasers. To enlarge the tap,



AN ADJUSTABLE TAP.

loosen the screws in plate *B* and turn the adjusting screw in, and then tighten the screws again. The adjusting screw fits the head and the plate, so that when adjusting the tap each chaser moves out alike, and the tap is always concentric.

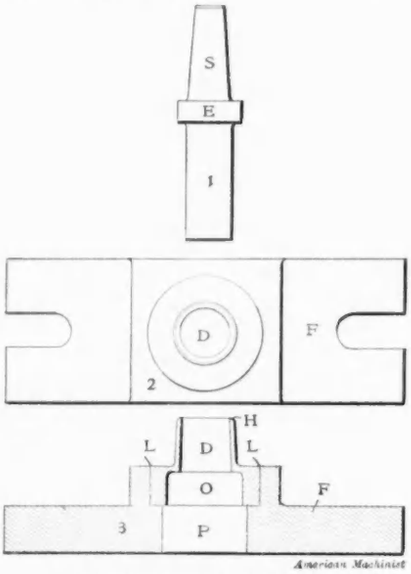
FRED. C. WORDEN.

Die Making—Foot Press Piercing Tools.

Editor American Machinist:

It is quite probable that few of the earnest and regular readers of the "Amer-

ican Machinist," except those engaged in the manufacture of sheet-metal goods or novelties, have the least idea of what value and use the foot press is in these large brass manufacturing concerns. We make tools, used in connection with the foot press, for blanking, piercing, bending, clipping, perforating and various other operations. Many jobs accomplished with foot-press tools could hardly be done successfully in any other way, as, for example, blanking out the little second hand for a watch, and many other similar and delicate operations. It seems to me that every step of progress in toolmaking is first of all an act of an individual, then of a minority, large or small; so I send you a brief description and a sketch of a simple set of foot-press piercing tools (for tapered German-silver fer-



FOOT-PRESS PIERCING TOOLS.

rules), which we have used for some time in our factory, and which perhaps are used in shops elsewhere; still, these tools may be new to some of your readers.

1 is the piercing punch, which is made of good quality tool steel, but is not hardened; the shank S is turned tapering to fit the hole in the gate of the press; the shoulder E is left square, so that the punch can be taken out by the use of a wrench. 2 is the top view of the die and die bed, and 3 a sectional view of the die D and the cast-iron die bed F as they appear when ready for use.

In making tools of this kind we make the punch first, then plane off the bottom of the cast-iron die bed F; strap it on a lathe face-plate, drill the hole P through it and bore out the die seat L. In making the die we turn up (in a chuck) the die blank D to fit the die seat L, and "back" it out as at O. The die blank is then driven into its seat at L (assuming that we have not taken the casting F off the face-plate after its previous operations), and the upper part of the die is turned off to conform to the size of the inside of the sample tapered ferrule. Now we drill and bore the hole at H with about 1 degree clearance, so that the scrap piercings will drop out at O. After the die has been hardened carefully we polish it off and draw it down to a straw color.

MATTATUCK.

A Simple Jig.

Editor American Machinist:

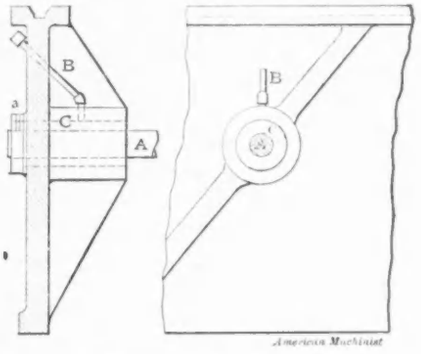
The drawing herewith shows a jig for drilling holes in the bevel periphery of blank a. The blank is bored and provided with a keyway. It is then slipped on stud B, which has a key and a knurled knob to secure blank in place. Stud B carries at its rear end an index plate D, also secured by a key and nut. The index plate is locked in position by means of the spring bolt E, which slides in a bush driven into the jig casting. The locking bolt is kept from turning by means of a small pin (not shown) driven through the wall of the bush and resting in a longitudinal groove cut in the outside of the bolt.

S. F. ARTHUR.

Oiling a Planer.

Editor American Machinist:

In a little shop, away down where I spend the time after pay-day waiting for the next pay-day, we had a planer of a well-known make. The driving shaft A, carrying the larger gear, had its bearings in two cast-iron sleeve boxes C. The oil hole a was placed in the sleeve by the builder. It is easy to see what became of the oil. The result was a pair of broken bearings. Two new sleeves were made to replace the broken ones, and a 3/8-inch



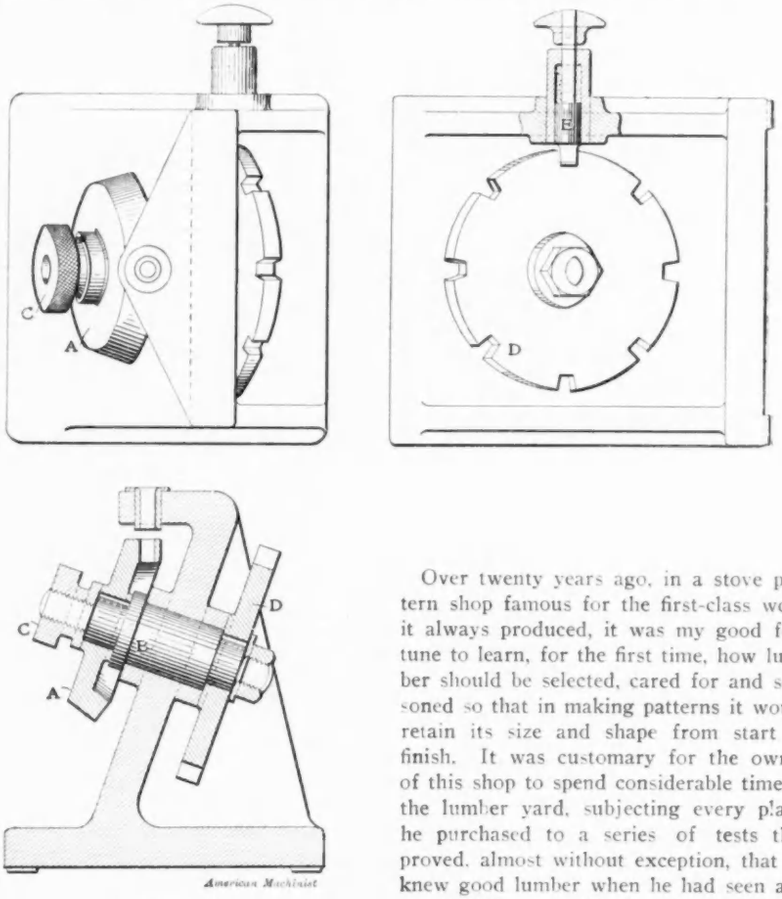
OILING A PLANER SHAFT.

gas pipe was put in, as shown at B, which overcame all difficulty. "And they lived happily ever after." LUBRICATOR.

Pattern Lumber.

Editor American Machinist:

As a rule, there is little attention paid, by concerns that sport pattern shops, to the selection, care and seasoning of pattern lumber, and for their benefit, as well as for the younger members of the craft, I can offer a little on that subject.



A SIMPLE JIG.

Over twenty years ago, in a stove pattern shop famous for the first-class work it always produced, it was my good fortune to learn, for the first time, how lumber should be selected, cared for and seasoned so that in making patterns it would retain its size and shape from start to finish. It was customary for the owner of this shop to spend considerable time at the lumber yard, subjecting every plank he purchased to a series of tests that proved, almost without exception, that he knew good lumber when he had seen and sounded it; and this is what I learned

from him, which my own experience has borne out:

Always select the widest planks, for they are generally the best. Be careful to pick out only planks cut from or near the center of the log, commonly called "quarter-sawed." Don't discard a plank because of a knot or two when it is all right otherwise. Educate your hearing so that you can tell by sound whether a plank is dry or not, and don't place too much faith on the word of lumber yard employees as to how long the lumber has been in the yard. Look carefully at both edges and sides for wavers in the grain, and if the grain is not fairly in line with the plank, put it to one side, as it only means trouble in the future; and the same may be said of boards that are "skaky," though it needs some experience at times to judge whether a plank is full of "wind checks" or not, as surface indications are often very deceptive, and the only infallible test is by sounding; and that will require a little practice. If you come across a plank with a few worm holes along the edges, don't hesitate to choose it, regardless of tests, for worms and grubs are the very best judges of lumber known, and if kind nature would only place this stamp of superiority on all good lumber, the trouble of selecting would be reduced to a mere superficial examination of the same.

When the lumber was delivered at the shop every plank was cross cut in half, and any that showed the least sign of being wet were set aside in a special rack, on edge, where the circulation of air was good; the rest the boss kept in racks, also on edge, for at least a year before using; and he never resorted to that trick of the lumbermen, of painting the ends of a board to prevent splitting, as he contended that most of the moisture made its exit through the ends by way of the pores, and that it was only poor lumber that split when drying, and to paint the ends only retarded the seasoning and promoted the formation of what is erroneously called "dry rot." If you will look closely at the ends of your best planks, you will notice little deposits formed around the pores by the sap exuding therefrom, which may convince you that there is something in the claim.

As to the kiln-dried stock, my own experience has been that it is not to be relied upon, even for the cheapest class of pattern work, and I well remember when this fact was first impressed on my mind. We were making a large "steam end" cylinder for a salt-water pump. The job was started in damp weather, which continued until the pattern and core boxes were nearly finished, when dry weather set in, which had the effect of rending asunder every piece of kiln-dried stock used, with a peculiar cracking sound that became monotonous by its frequency, and made the boss doubt whether there would be enough of the pattern and core boxes left to send to the foundry. "Old Bob."

Fixture for Milling Star Wheels.

Editor American Machinist:

Fig. 1 shows a four-slot intermittent star-wheel used to obtain an intermittent revolving motion. To make this wheel so that it will run smoothly in conjunction with its driver these slots must be milled exactly at right angles and the arcs must be struck from centers which exactly bisect the angle included beween the centers of the slots, and the centers must also be equidistant from the center of the star wheel. Those who have had any experience with this movement will readily appreciate the continual pounding which would follow a faulty spacing of slots and arcs. In Figs. 3 and 4 are shown two fixtures which satisfied us as being the proper articles to accomplish the required result in manufacturing the star wheels. They are the development of an idea suggested by Mr. C. H. Rowe.

Fig. 3 is a plan and section of the fixture for milling the slots across the face of the star wheel. The wheel is shown in position on the fixture. The star wheels, being first bored and turned in the lathe, are located in position in the fixture by the stud *C* and secured by straps *D*, the bunters *E* being set up with thumb-pressure after straps *D* are tightened, to avoid any possible chance of springing the stud *C* if the cutter was being forced hard.

At *F* a slot is milled in line with the center of stud *C*, which is for the purpose of centrally locating the cutter, so that the slot milled across the face of the star wheel will pass through the center. *G* is a finger at right angles to *F*, which, after one slot has been milled, locates star wheel in correct position for milling the second slot. The tongue on the bottom fits in the groove of the milling machine table.

After having milled the slots in the wheel, as above described, we use the fixture shown in Fig. 4, in conjunction with the counterbore Fig. 2, for counterboring the arcs on the face of the star wheel. The star wheel is located and clamped in this fixture in the same manner as in Fig. 3, except that instead of a short finger like *G* we use a long key *H*, which lines the slot in the star wheel with the slots which have been milled in the fixture in a position parallel with the base of the fixture and central with the stud on which the star wheel is located. This key is held in slots by thumb-screws *I* in latches *J*. At *M* a bushing is located the required dis-

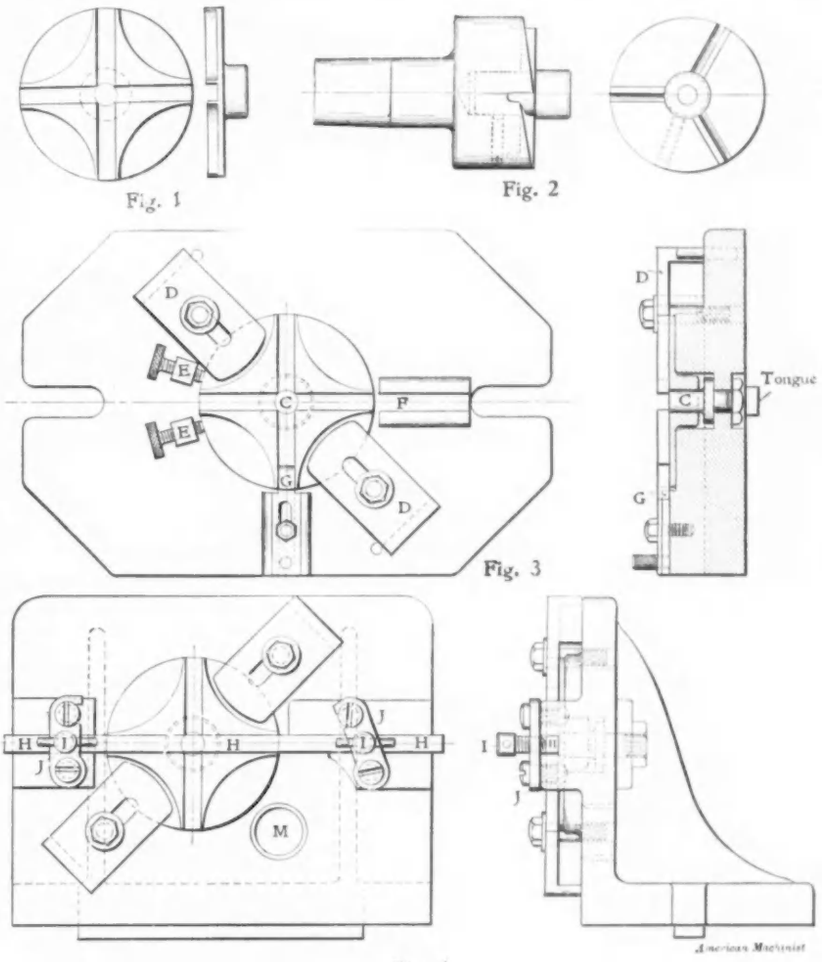


Fig. 4

FIXTURES FOR MILLING STAR WHEELS.

tance from the center of the star wheel, and at a 45-degree angle from the center of the slot which key *H* sets in. This bushing is a guide for the counterbore. The counterbore was made from a piece of "Crescent Extra" tool steel; after being hardened it was ground to size, and the shank was fitted to the milling-machine spindle. W. M. SPRY.

An Improved Method of Molding Feed Rollers.

Editor American Machinist:

The quick and accurate molding of feed rollers for chaff-cutting machines is a very important item in any factory turning out large numbers of this class of implements, as two rollers are required for every machine, be it large or small, the

FIG. 1. A PAIR OF THE ROLLS TO BE CAST.

lengths and diameters varying according to the size of the machine. Fig. 1 shows a pair of feed rollers of medium size, one having flanged ends and the other without. These castings are required to run true in the lathe, a variation of 1-16 inch causing them to be rejected.

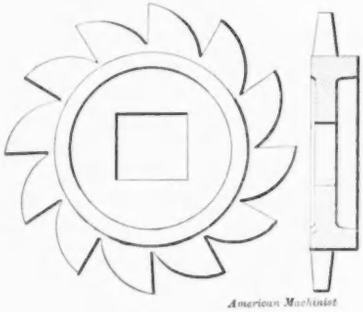


FIG. 2. A SINGLE STAR.

Many methods of molding feed rollers are in vogue. In some foundries the roller is made up of single stars having a square hole cast in the center of each, as in Fig. 2. These single stars are faced in the lathe and packed closely together on a square shaft until the desired length is obtained. Another method is to have a complete pattern made to mold on end. This pattern is so constructed that, after ramming up the mold, a central turned core is withdrawn and the various pieces holding the spike-like projections are drawn inward. This is a somewhat slow process, and it requires a fair amount of skill to work at all.

The method which, as far as ascertained, finds most favor where large quantities of rollers are required, is to mold the stars singly on a stripping plate machine, the top joint of each star mold being formed by a sweep working on a spindle. As the molds are made they are piled one on top of the other until the right number of parts to complete the

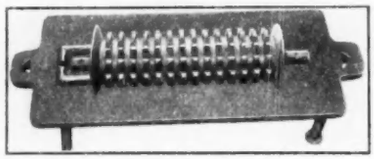


FIG. 3. THE PATTERN PLATE.

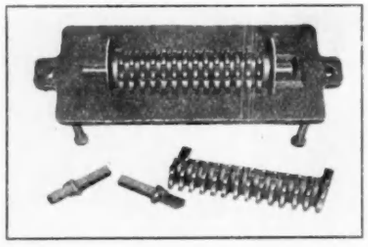


FIG. 4. PATTERN PLATE WITH LOOSE PIECES DRAWN.

roller is made. The single parts are located over each other by means of a bottom plate having two long pins, over which each part, having holes to match, is lowered. Many excellent castings are made by this method, and when the complete set for molding, say, twenty pairs of rollers per day, consisting of about 240 single flask parts, faced top and bottom, and all drilled to templet, the bottom plates, one to each roller, having long turned pins as before alluded to, and various plates to form the tops and bottoms of the star rollers, besides the stripping plate machine; when this complete plant is brought from the fitting shop it looks as if we could keep on making rollers until doomsday. But after a while things get out of order, castings don't run true in the lathe, the lengths of the rollers vary, and there being so many parts about this plant to get out of order that it is a difficult matter to locate the trouble, the fitter is always pottering about the job. It is never right for a month but it is wrong for a similar period. We have come to the conclusion that the cupola is the best place for it.

After considerable study the improved method here shown of molding feed rollers was tried and found to work satisfactorily. The parts to get out of order are few, consisting only of flask and pattern plate, Fig. 3, having on its face a complete half pattern. The plate rests on four legs on the bench. As a complete half pattern is used, a two-parted flask only is required. The flask is tapered, and has adjustable pins and holes; the pattern plate also has adjustable holes.

To mold a roller, the drag part of the

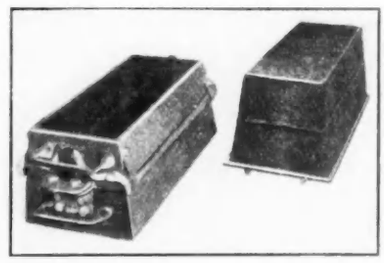


FIG. 6. A FLASK AND A MOLD.

flask is placed on the pattern plate, sand is filled in and rammed, the plate or board is dropped on and the flask is turned over. Two loose pieces working in slides are drawn from the back of the pattern plate. The first piece is drawn completely out, but the other is drawn only about 1 inch, when it is stopped and held by a small handle turned crosswise over the opening

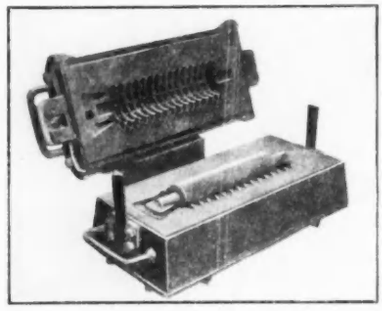


FIG. 5. MOLD READY FOR CLOSING.

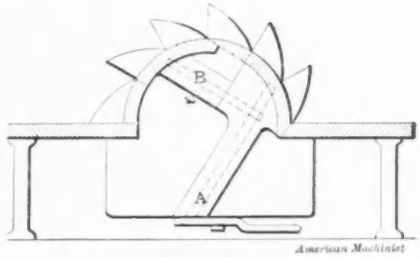


FIG. 7. SECTION OF PATTERN PLATE.

in the back of the pattern plate. The plate is now lifted off the drag, leaving a perfect half mold. Fig. 4 shows the pattern plate after having been worked on the drag, also the loose piece. The two pins shown are now placed into the holes in the pattern plate, and the top of the flask is placed on, rammed and the pattern drawn as before. The core is set in the drag and the mold is closed. Fig. 5 shows the mold ready for closing. When

the mold is closed the flask is lifted off the mold and the mold is set on the floor. Fig. 6 is a print of the flask and mold. When lifting the flask off the mold, the thumb is pressed on to a flat plate near the handle of the flask, which causes two parallel strips which project inside the top part of the flask at the joint, to spring out of the flask, leaving the mold clear. The

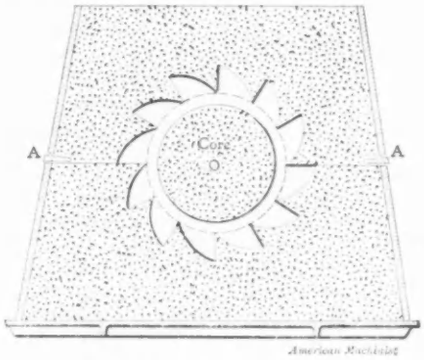


FIG. 8. SECTION OF MOLD.

flask is now lifted off. Fig. 8 shows a section of the mold. The strips which hold the sand in the flask are marked *A*. The section of the pattern plate, Fig. 7, shows the loose sliding piece. *A* is the piece which is drawn out completely, and *B* is drawn clear of the mold. We find this method to be simple and quick to work, and by its help we are able to produce really duplicate castings.

GEO. BUCHANAN.

Wrexham, North Wales.

More Experience With the Premium Plan.

Editor American Machinist:

The following experience with the premium system, its introduction and development, may be interesting and helpful to others:

Several years ago the writer took charge as superintendent of a shop manufacturing several small specialties, the plant consisting of drop forge, machines and polishing departments. The works at that time were being operated on the day-work system, which left much to be desired in the way of production. As the product consisted of small pieces made in large quantities, the problem of how to increase production seemed to find its solution in the piece-work system.

After rearranging the operations to conform to our proposed system of piece work we put the plan in operation, with the result of a large increase in production. After two years' trial of the piece-work system, during which time the feeling (common to all piece-work shops and justified by past experience that an output above a certain amount would result in a lowering of the price) manifested itself in a reluctance to produce more work, although much money had been spent in improving the tools and machinery.

We then decided to give the premium system a trial, hoping thereby to enlist the best efforts of the workmen, with resulting profit to employer and employee. The several operations to be performed on each piece were so divided that each machine was run continuously on one operation, and each man attended as many machines as he could keep in operation.

Taking the production under the piece-work system as a basis, the number of pieces which should constitute a standard day's work was fixed, as was also the premium allowed, the latter being governed by the character of the work. In considering the premium to be allowed, we followed the general principle, that a higher premium should be paid for work performed wholly by manual labor than for that performed almost entirely by machinery, for the reason that any increase in the number of pieces turned out, for instance in drop forging, is directly the result of increased exertion on the part of the workman, while improved machinery in other departments may largely increase the output for the same outlay of labor.

For drop forging and like operations, the premium was fixed at 50 per cent., while for machine and similar operations it was made 33 per cent. of the price for a standard day's output. Except where radical changes had been made in machinery or methods, we fixed the number of pieces which should constitute a standard day's work at the amount formerly produced by the piece workers, allowing the same price for the day's work that he would have received for piece work. It was also agreed that no change in price or premium should be made unless there should be a radical change in machinery or methods of operation, or that business conditions should necessitate a general reduction in expenses.

A few of that class of workmen found in every community who constitute themselves a committee to safeguard (?) the interests of their brethren saw in this system another move of the enemy, and set themselves to the task of bringing the others to their way of thinking, but with little success; the majority of the workmen entered at once into the spirit of the arrangement, giving that attention to each detail of the work which resulted in improvements, many trifling in themselves, but altogether resulting in a very marked increase of product and earnings.

The average production per man was increased over 50 per cent., with a corresponding profit to employer and employee.

After one year's trial I believe there are none in office or shop who would willingly return to the day or piece-work system. The office can view with complacent satisfaction the large increase in the earnings of the workmen, knowing that it also means a large decrease in the cost of production.

I am convinced that the premium system, if administered in a fair and liberal spirit, will do away with one cause of the ill-feeling which too often exists to disadvantage of all concerned. E. C.

Centering Offset Governor Arms.

Editor American Machinist:

I had to make a lot of governors, of which the arms were to be as shown in Fig. 1. These arms came from the blacksmith, and were first to be corrected and then centered for turning. Lugs *n n* were left for the centers. The arm was first clamped to a small V-block, Fig. 1, two bits of tin, the thickness of each equal to half the difference between the diameters *D* and *d*, making up for the taper, clamping it just tight enough to hold it in place. Then the V-block was turned over with the side *F* on top, Fig. 2, and the left wing brought parallel with the face-plate. In this position the clamp was tightened and one center line was drawn over all four

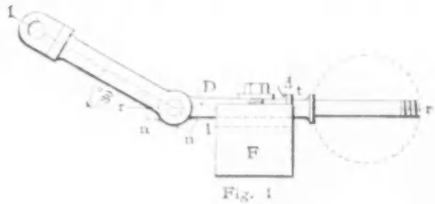


Fig. 1

Fig. 2

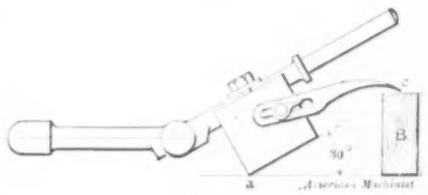


Fig. 3

CENTERING GOVERNOR ARMS.

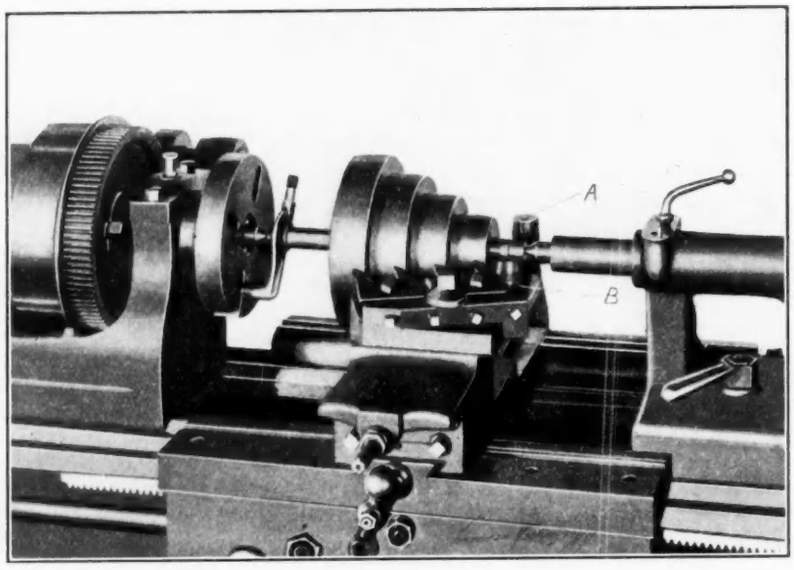
ends. Then the V-block was brought back to the first position, and *r r* was drawn. The line *l l* was drawn this way: The V-block had an adjustable pointer attached to the side of it. With the V-block as in Fig. 1, the point was brought to touch the face-plate, and then the block was tilted 30 degrees (see Fig. 3) by making the hight of the block *B* equal to half of the distance *A C*. J. SCHURING.

A Cheap Rig for Turning Cone Pulleys with a Proper Crown.

Editor American Machinist:

The photograph shows a fixture used on an ordinary 16-inch lathe for turning cone pulleys. This method cut the cost about 80 per cent. It consists of the tool-holder, shown bolted in place of the tool-post, and the guide arm, pivoted to the cross slide at *B* on one end and swinging on a stud fastened to a block in the guide of the taper

attachment, at *A*. The tool-holder has a strap and clamping screws to hold the tools, and set-screws are provided for adjusting the tools. When the tools are once set, the calipering is reduced to the minimum, as it is only necessary to caliper one step of the pulley. The radial guide arm gives a crown which we prefer to the common practice of an obtuse angle flattened on top with a file.



A RIG FOR CROWNING CONE PULLEYS.

The pulley shown is 8 inches at the large step and 3 inches at the small step. The roughing cut reduces the diameter ⅛ inch, with a feed of 30 per inch. The tools are made of Styrian special steel and are set to give a top rake of about 25 degrees, with the least possible clearance, and to face the steps without changing tools. The same crowning rig is used for single pulleys.

We would be pleased to see some machine tool builders adopt this or some other method of crowning their pulleys. While it may not make any material difference in the running of the belts, the angular crown is unsightly.

W. A. WARMAN and R. B. COCHRANE.

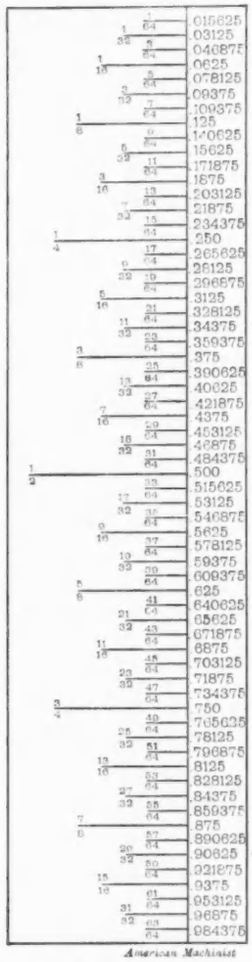
A Convenient Table of Decimal Equivalents — Photographing Parts of Machinery.

Editor American Machinist:

I enclose a decimal equivalent table which seems to be liked. The idea is, to arrange the equivalents in the form of a scale, this being the feature which makes it easy for the average man to readily catch the decimal required, especially those who are used to measuring off distances on a scale by their thumbs.

Paste the scale on a piece of cardboard, or better stick it on with shellac; shellac the outside well, and carry it in the vest pocket.

It is often necessary to make additions or corrections on blueprints; for this purpose I use a solution of neutral oxalate of potash; make a saturated solution, and reduce by adding 1 or 2 parts water. This gives good, clear whites by destroying the blue of the print, and does not have the objectionable features of the caustic soda. By adding a few drops of red ink, changes are given especial prominence on the print. The neutral oxalate of potash is one of the ingredients used in photography, and can be readily obtained at any store handling photographic materials.*



A CONVENIENT TABLE OF DECIMAL EQUIVALENTS.

In the shop there are many chances of using photography to advantage. Workmen like to see the "real thing" they are working on, and get a better idea of the object from a photograph than from the drawing. It is quite a problem sometimes to take these photographs without disagreeable shadows, and the problem is still further complicated by trying to photograph several pieces together.

When it is desirable to photograph parts with numbers attached and have the parts placed in relation to one another for catalog work, I have originated a scheme which has decided advantages.

Support a piece of plate glass about 12 inches from the floor, previously laying white paper on the floor. On top of the glass place the objects, with the labels, etc., required, and elevate the camera over it on a stand made for this purpose.* The advantage of the plan is that there is an entire absence of those very disagreeable shadows common to this work as ordinarily done.

WM. V. LOWE.

Winchester, Mass.

Two Cutting-off Tools for Automatic Screw Machine.

Editor American Machinist:

Having a large quantity of ball-bearing cones to make from the bar, we decided to increase production somewhat by making two at once. A circular forming cutter was made which left the work as at Fig. 2. The cut-off tool post was then got out, with of course the proper distance between the two tools. In working, the outside tool (nearest the turret) was set slightly in advance of the other, thereby cutting off the outside cone first. The

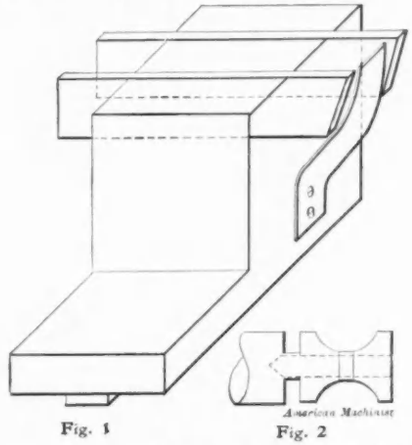


Fig. 1 Fig. 2

A DOUBLE CUTTING-OFF TOOL FOR AUTOMATIC SCREW MACHINE.

*Mr. Lowe encloses some blueprints with sample corrections. The results are far better than those obtained with caustic soda.—ED.

scheme answered all right with the exception that the inside cone, on being cut off, stuck between the tools and caused a jam when they came into work again. To overcome this we fastened a flat steel spring, bent to the shape shown in Fig. 1, on to the front of the tool-post. As the tools came into work the spring was forced back until the cone was cut off, when the spring resumed its normal position, of course forcing the cone from between the tools.

W. HOUGH.

Wolverhampton, England.

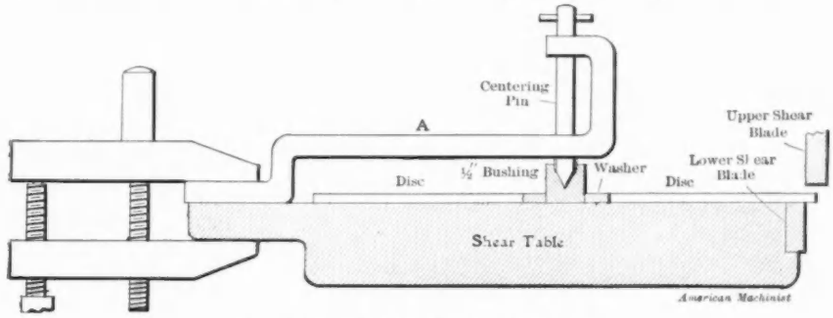
Making Sheet Metal Disks.

Editor American Machinist:

I had to make a lot of disks of sheet metal 1-16 inch thick and under, with diameters varying from 1¾ to 14 inches, some with holes ⅛ to 2 inches and some without any holes, and they had to be practically true. Cutting the heavy ones with a pair of "tin snips" was out of the question, and as we had a foot-power squaring shear 30 inches wide I decided to make use of that.

I first cut the sheet metal into squares, then scribed diagonal lines and marked the centers, drilling holes where required, center punching the others. I then had a piece *A* of ⅜x1 inch machine steel bent into the shape shown and drilled the two holes for the centering pin which I made of ⅜-inch round cold-rolled steel 6 inches long, pointing the end and putting in the cross pin for a handle. I clamped this guide *A* in position on the table of the squaring shear, and, scribing a circle on one of the disks which had no hole in it, I had simply to insert the center point in the prick punch mark of the blank, set it so that the shear blade just cut outside the circle and by working the treadle and turning the blank by 10 to 15 cuts I got a polygon near enough to a circle to finish by grinding. For the grinding I rigged up a small wooden stand or table, screwed a sheet metal top 1-16 inch thick on it and nailed this in position close on to the side of a dry grinder, and, clamping piece *A* to this improvised table, rotated the disks in contact with the wheel and ground them perfectly round. Having a great many of these disks to make I put an apprentice at it and it was surprising to see how quickly they were finished. For the center pivot for the disks with holes I made bushings, as shown, for the smaller holes and for the larger holes dropped a washer over the bushing.

BERT LACHMANN.



RIG FOR SHEARING SHEET METAL DISKS.

Making Cheap Gear Patterns.

Editor American Machinist:

I have noticed lately a number of communications about making wooden gear patterns. As the writers differ mainly in the method of forming the teeth by means of a templet from small blocks of wood, the inference is that the usual method of making such patterns is to afterward space and fasten these teeth to the rim of the wheel. A method which I have seen used in a jobbing shop in the sawmill region of Michigan, which differs materially from the usual method, may be of interest to your readers.

This shop had a great many of such patterns to make, mostly for repair jobs and consequently in a hurry, and as the usual process was found necessarily quite slow and required considerable care, the following practice was adopted:

The rim of the gear was built up as usual and fastened to the face-plate of the wood lathe and the outside turned to the diameter at the bottom of the teeth. The rim was then spaced and blanks were fitted and fastened in their required places. The pattern was again turned to the outside diameter of the teeth, and the sides of the rim and the ends of the teeth were finished to the proper width of face. On the ends of two or three teeth was laid out the correct shape of the tooth.

The spaces were then cut to shape by the device shown in Figs. 1 and 2, which was attached to a 24-inch lathe. A casting *A*, Fig. 1, was of the required shape to fit the cross-slide in place of the tool post and fastened by two bolts. A piece of 3-inch pipe *B* was turned and fitted to this casting so that it stood vertical. A collar *C*, adjustable to any position on this standard, could be clamped by means of a bolt. This collar carried a stud which centered and clamped a sleeve a portion of which was threaded to fit the face-plate holding the gear blank. Another small collar *D*, fitted with a pointer, was also clamped to the standard and served as a guide in spacing the gear in accordance with the divisions already made.

Two pieces of maple, *E E*, Fig. 2, about 2½ inches thick, were notched to fit the ways of the lathe and bolted to the bed. These blocks held two cast-iron babbitted bearings approximately in line with the centers of the lathe, a shaft revolving in these bearings had on one end tight and loose pulleys *F F* driven by a 2-inch belt from a convenient pulley on the line shaft. On the other end was a cutter head *G* similar to those used on wood molding machines, having two knives, one for forming each side of the tooth.

The pattern, after being prepared as described, was mounted on the standard, properly indexed and clamped with one of the marked spaces in front of the cutter. The arbor was then started and the blank fed across the cutter, the setting of the knives being such as to insure not over-cutting the lines denoting the proper shape of the tooth. The knives were then adjusted or filed as indicated by the correspondence of the cut and the line, and the operation was repeated until the correct shape was

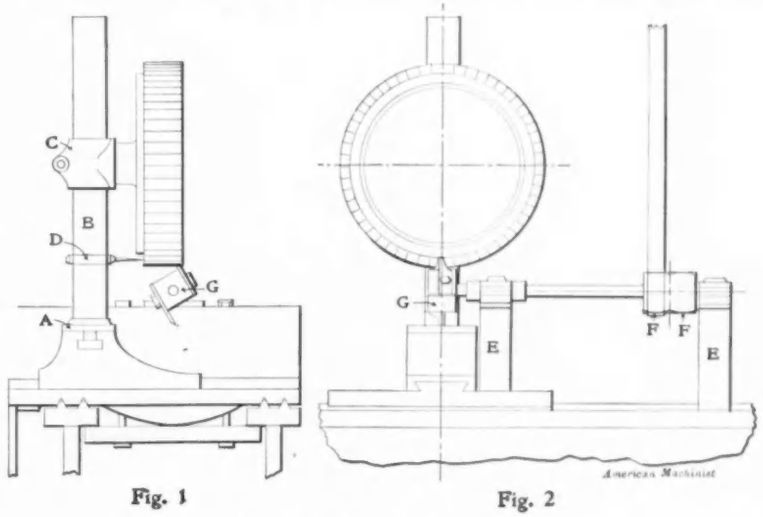


Fig. 1 Fig. 2

MAKING A SPUR GEAR PATTERN.

obtained, generally two or three trials being sufficient.

The gear was then cut around, indexing by the marks previously referred to, one entire space being cut at one passage. The draft was obtained by inserting strips of tin under the edge of the plate *A*.

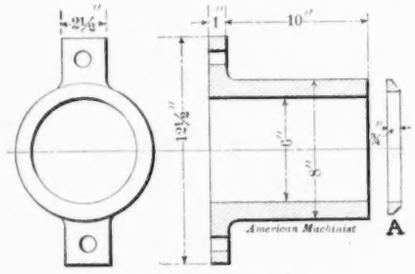
The teeth of patterns produced in this way, besides being accurately formed and spaced, required very little draft, molded easier and produced much better running gears than those previously made. The device cost very little in time or material, and has been found extremely useful for other purposes. The standard of this rig was afterward replaced by one of cast iron provided with a saddle adjustable vertically by means of a screw, and to which was fitted a 9-inch Brown & Sharpe dividing head. E. C. OLIVER.

Stock for Piston Rings.

Editor American Machinist:

The other day I saw the boys in the shop wrestling with the problem of piston rings, trying to get them perfectly true, without any flat spots. It seems that at every place where a clamp was fastened, the ring would show a flat spot when taken out of the lathe. That brought to my mind a case of that kind that happened some years ago, when I worked at the lathe, including the trouble we had at first, and the remedy which was found only after a good deal of cutting and trying.

A lot of piston rings were to be made, and for stock to make them from, we had some castings made, like sketch, with two



MAKING PISTON RINGS.

wings or ears to strap them to the faceplate. The castings arrived and, after being pickled and cleaned, were turned over to me to make the rings from. I strapped the first one on very carefully with little pieces of pasteboard, so they would not spring. Then, after roughing them off, inside and out, right up to the ears almost, I started to finish and cut off the first ring, as shown at A. Right here is where the trouble commenced. After the ring was cut off, I found it to be .02 inch flat; that is, the diameter across the ring opposite the two ears was found to be that amount smaller than the opposite diameter, although it had been calipered repeatedly while in the lathe, and found to be perfectly true. I tried another ring, and another, but the nearer I got to the faceplate the worse they seemed to get. The next casting I faced off nice and true, thinking that would fix it, but found little or no difference. Next we had castings made with four ears set at right angles, and with the rear end faced off carefully. The only difference that made was to give us four flat spots instead of two. So finally we did what we ought to have done in the first place, namely, had the castings made with a flange all around, and that settled it. After that we had no trouble; the rings came out nice and true.

Now, it seemed almost impossible that the pressure of the clamp on the ear of the casting could be felt and affect the diameter of the rings through the whole length of the cylinder, 10 or 11 inches. I have not been all over the world yet, and it is very likely that some of your readers have been through all this and know all about it; but it may reach some fellow who doesn't know, and then the mission of this little sketch will have been accomplished. M. H. C.

A Radius Tool for the Lathe.

Editor American Machinist:

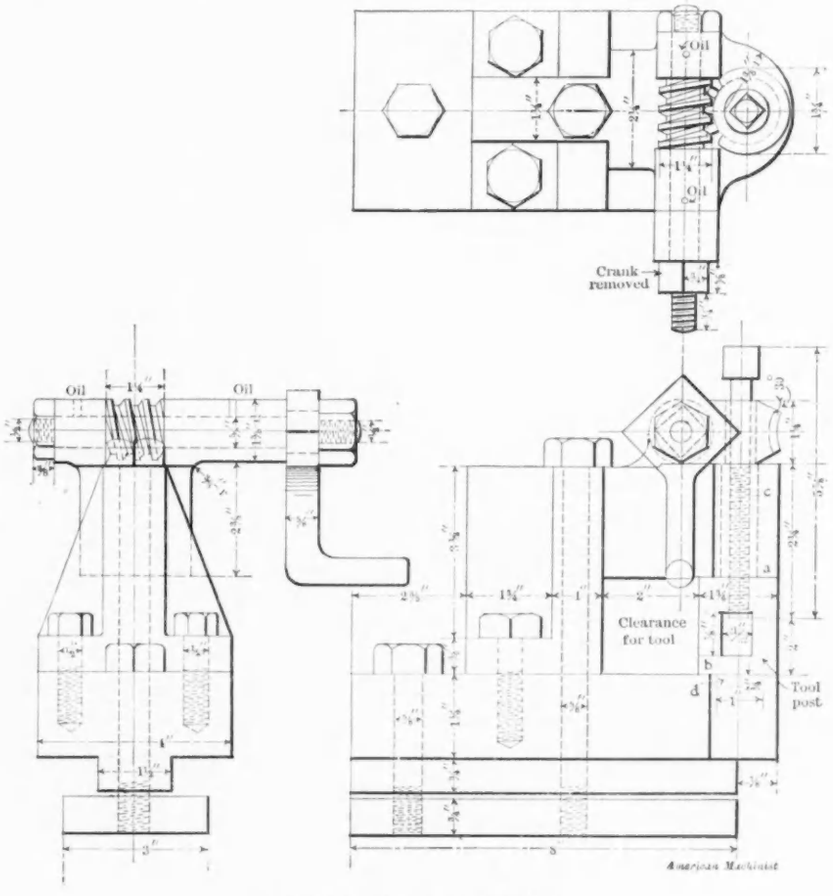
The device shown in the accompanying sketch is one which has the merit of being in actual use for turning pipe rolls for welding lap-welded pipe. The sketch shows plan, side view and rear view, the rear view being the way the machinist sees it as it is fixed to his lathe. It is used on a lathe having a T-slot for the tool-post. The tool-post is removed and this device clamped in place, a clamp fitting the bottom of the T-slot, the bottom of the piece being dovetailed to fit the neck of the slot tightly, to prevent any play. The compound rest is turned to 90 degrees and its feed screw is used to adjust the tool opposite the center, the cross-feed screw being used to adjust it in and out. The tool-post is a working fit at joints *a b*. A neck *c* connects it to the worm wheel and a steadying pivot *d* acts with *c* as a journal on which the tool-post turns. The carriage is run nearly to place and clamped, the radius being formed by setting the tool in the tool-post with its nose at a distance equal to the required radius from the center of the tool-post. The tools are of ⅝x¾-inch self-hardening steel, and can be easily set by subtracting half the diameter of the tool-post from the given radius, which gives the distance from the face of the tool-post to the nose of the tool. E. J. H.

P. S.—That guide sheet of Wm. Pilton in No. 13 hit me just where I live.

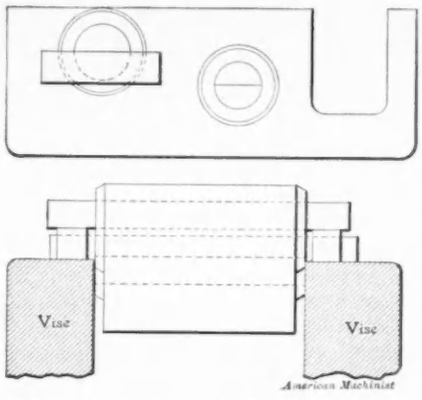
A Trick in Chucking on the Milling Machine.

Editor American Machinist:

The sketch shows a finished box, faced off at *B* and the holes accurately drilled



A RADIUS TOOL FOR THE LATHE.



LEVELING A PIECE IN THE CHUCK BY THE HOLES.

after a jig. For some reason there was ⅛ inch more to be taken off at *B*. To get this new face exactly parallel with the holes in both directions, I took two pieces of cold rolled steel, of ⅞ and ¾ inch, to fit the holes, split them in halves, put a ½-inch liner under the ⅞ holes and tightened the piece in the milling machine vise. The boxes, twenty-four in number, were done in a very short time, without using a surface gage or square to true up with. A piece of shaft split and accurately scraped down to its center, will make a handy tool in similar kinds of work or for laying out brackets, levers, etc. E. K.

[In the case shown in the sketch, it would seem that round pins would have done as well as the half-round, except that perhaps they would have raised the piece too high in the vise.—Ed.]

Rig for Cutting Screws of Steep Pitch

Editor American Machinist:

Fig. 1 shows a screw and nut with quadruple thread, making one turn in 2½ inches. The outside diameter of the screw thread is 1½ inches and its length 4⅝ inches. The head of the screw and the outside diameter of the nut are the same—2 inches. To make this screw and nut, the chuck, Fig. 2, was designed. It consists of two principal parts *A* to screw on the spindle of an 18-inch lathe, and *B* having a split hub bored to receive either the head of the screw or the nut, either being clamped tightly therein by the screw *C*. Four slots *S* served to index the four threads as they were successively placed over the square end of the stud *N* riveted into the part *A*. Two bolts *E*, Fig. 3, clamped *A* and *B* together, and two screws *g* forced them apart in case they stuck.

The first screw and nut were made with the chuck as described, the outside cylinder D not having been at that time thought of; the pitch being obtained by compounding the gears to get 2½ inches of longitudinal travel of the carriage to one revolution. After many trials, cuss words, regrinding and resetting of tools, the threads were finally cut. The slightest extra thickness of chip would stop the lathe, and the way those gears would spring and jump as the power was twice transmitted from the largest gear to the smallest pinion to make that lead screw whiz as

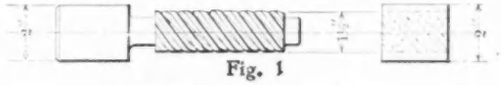


Fig. 1

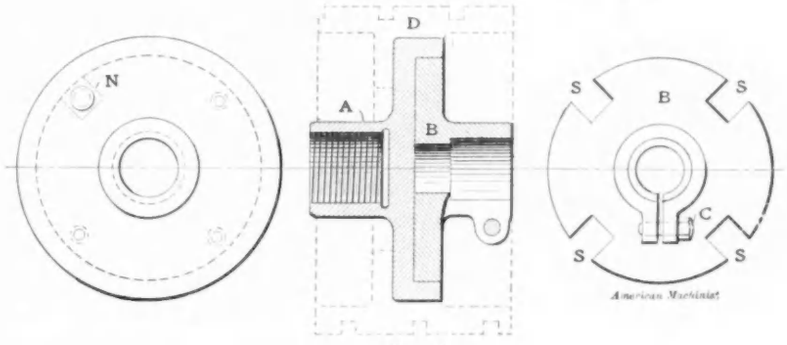


Fig. 2

A STEEP PITCH SCREW AND NUT AND A CHUCK FOR HOLDING THEM.

required, was enough to make a man design webbed gears entirely if he should ever leave the shop for the drafting room.

The writer was asked to improve the apparatus. This was accomplished by making the cylinder *D*, shown by dotted lines in Fig. 1, to drive the carriage instead of the lead screw. It was 12 inches diameter, with a flange on the inside which bolted to the back of the part *A* of our original chuck. The cylinder was somewhat longer than the threaded portion of our screw, and it had a screw thread about ⅝ inch wide and ⅝ inch deep cut its entire length, one turn in 2½ inches. It is evident that in cutting this we would have had more trouble than we had with the screw. What we did was to make some cast-iron blocks and raise the centers of the Brown & Sharpe universal milling machine about 2 inches to swing the cylinder, and by using an end mill and the proper gearing we got the thread all right.

The carriage was connected to the cylinder by means of the piece of steel *R*, Fig. 3, which was bolted to it through the holes *t*. In the other end of *R* was the pin *o*, whose head was milled to fit the screw grooves in the cylinder and was free to turn to allow for inaccuracies in bolting on to the carriage. *Q* is the boring tool and holder for cutting the nuts. The apparatus is not very handsome, but it does the business, which sometimes handsome things do not. "TOGGLE."

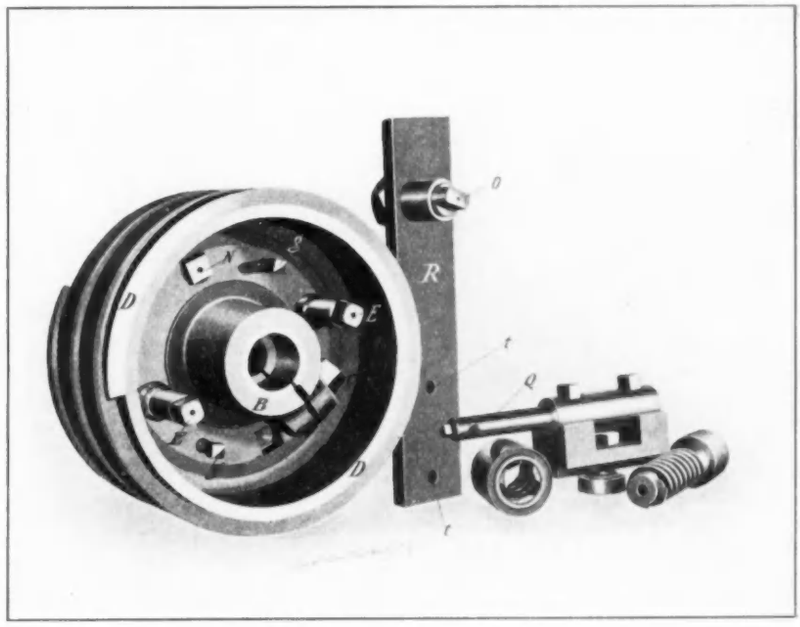


FIG. 3. RIG FOR CUTTING STEEP PITCH SCREWS.

A Tool Checking System.

Editor American Machinist:

The following system of tool checking is a combination of two different systems devised when I was in a shop where there was considerable trouble with tools. It is not the cheapest system to establish,

A. B. & C. Co.

TOOL CARD

FILES

	SIZE	NO.	STYLE
ROUND	6" 8"	2	M. B.
H. ROUND	8" 12"	2	B. M.
FLAT	6" 10"	2	M. B.
SQUARE	4" 6" 8"	3	B.M.B.
SPECIAL	4"6"8"6"	4	2 3 4 5
DRILLS	1 Set.		
TOOLS	1 Set Lathe.		
	1 Set Shaper.		

MISCELLANEOUS

1 Lock. 1 Key. 1 S-wrench.
1 Monkey wrench 8".
1 Oil can. 1 Screw-driver.

John Jones.

American Machinist

CARD FOR LISTING TOOLS IN HANDS OF WORKMEN.

but in the long run it will save enough to pay for itself.

When a new man came into the shop, he was sent to the toolroom to get the necessary tools for the class of work he was to do. Two lists of these tools were made out, one on a red and the other on a green card, shown herewith. The red card was given to the workman, and the green one was retained in the toolroom. Each man was provided with a locker, a padlock and key, which were charged to him on his card.

A lathe hand was furnished with a set of lathe tools, oil cans, and other necessary tools. A toolmaker received in addition a set of drills from No. 60 to ½ inch. This set of drills saved a good many trips to the toolroom.

In the toolroom was a board with a space left to insert a card with the workman's name and a hook to hold the checks. Small wooden boxes were provided to hold the tools belonging to any one job. For instance, a milling-machine job would require a fixture, a cutter and gages. Each box and each tool in the toolroom were numbered. When the tools were in the toolroom the check was in the rack with the tool. When a workman got a tool, his check was placed in the rack, where the tool belonged, and the numbered tool check was placed on the board at his name. By this method it could be told at a glance just how many tools a man had out, and what they were.

The cards were copied from those used by the Duquesne Manufacturing Company, of Pittsburgh, and the check system is a modification of the one used by the Westinghouse Electric and Manufacturing Company at their East Pittsburgh shops.

F. YOUNG.

Be Sure You are Right, Then go Ahead.

Editor American Machinist:

Some years ago, when I was a young patternmaker, it was my lot to be employed by a high-strung man. Mr. B. was not ill-tempered, but he was easily rattled, especially if a rush order came in. One day such a rush order was received for a set of patterns, and the boss told me in a somewhat excited way that it was a very particular matter and that I must be sure and make no mistake. I agreed to do my best. On account of the rush he cut the blueprint in two and set to work on his half with energy. As I sat down to figure out my part I could hear him tearing around with hammer and saw and kicking up the biggest kind of a racket.

I got my pattern done, and was starting in to blacken her up, when Mr. B. came over to inspect my work. He was quick in speech and action, and almost as soon as he had grabbed the pattern he said: "Confound it; just as I expected. It's all wrong!" with which he flung the pattern clear over on to the scrap heap. I was nettled and surprised, and at once went over, picked up the pattern of the boss, and in turn I said, as I flung his pattern to the scrap heap, "Confound it, *that* pattern is dead wrong!" At that the boss took after me, and we dodged around for quite a while, but I was past-master of the game of shinny-round, and when I got him winded he began to cool down.

We then hunted up the print, and, as I pointed out a certain stroke, I said: "You see that dotted line?" He said he did. "Don't that mean that the bead should run under?" "Yes." "Well, here is your pattern with that bead on top." Mr. B. admitted it. I rather think he had a laugh at the supper table that evening. Anyhow, we got along first-rate afterwards; we had come to an understanding.

W. H.

A Boring Fixture for Small Rod Ends.

Editor American Machinist:

Enclosed you will find sketch, Fig. 1, of a brass rod end that is to be machined all over and to be made in various sizes, together with sketch, Fig. 2, of a fixture for boring the hole for pin bearing in same.

The first operation is to bore and thread the end for the rod. The second operation is to turn the outside which at present we are doing on the end of an arbor, and the third operation is to bore the end for the pin bearing in the fixture shown, which will take any size of rod end within its limit. The illustrations are self-explanatory. By the index lines marked *o* the fixture may be set for any length of rod end, the distance between the lines giving at once the distance from center to face.

H. R. BLUMBERG.

A Right and Left-Hand Band Saw.

Editor American Machinist:

Jobs will crop up with surprising frequency that will test the versatility of the band-saw, and I just want to toot my own

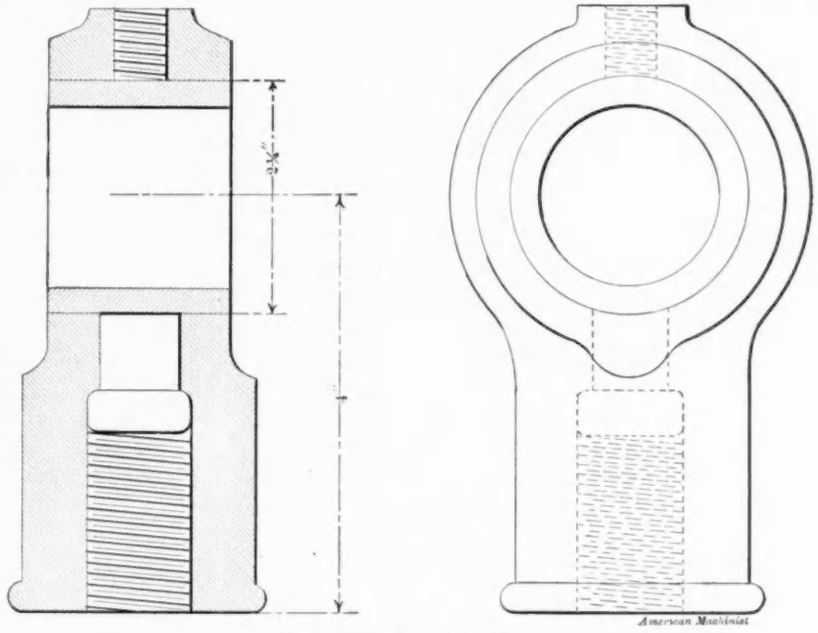


FIG. 1. ROD END TO BE MADE.

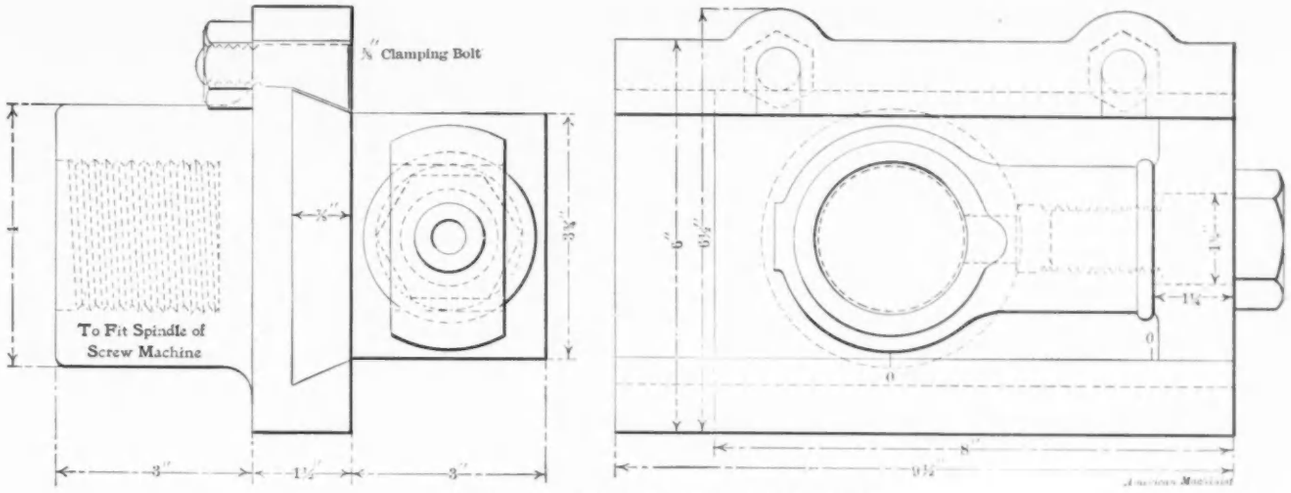


FIG. 2. BORING FIXTURE FOR SMALL ROD ENDS.

horn a little while I tip you off on a little kink that'll make a fellow feel like kicking himself for not knowing it before.

Years ago, while working in a pattern shop whose equipment included one band-saw of the usual tilting-table type, we had considerable side frame work to do that called for a lot of half-lap and mortise joints which it would pay to cut out on the band-saw, only the angle of half the number of pieces would persist in being "left-handed," and necessitated the use of hand-saw and plane, until one day, after putting in some good hard work, it occurred to me that if I took the saw blade off the machine and turned it inside out and put it on again, I could do something from the back of the table that was impossible from the front. And so it proved—only I had to push both upper and lower saw guides back to clear the saw points, and to make two wood guides to screw on the saw guards below and above the table. That took some time, though the boss didn't kick when he realized the import of the improvement when with its aid work was turned out much faster and better.

"OLD BOB."

Repairing an Engine Under Difficulties.

Editor American Machinist:

Back in the seventies I was in the employ of one of the iron companies of Northwestern Michigan with headquarters at Negaunee, filling (or attempting to fill) the position of master mechanic.

In those days the tools and methods of doing work were so radically different from what they are now that I think perhaps some of the things we did and how we did them might interest at least a few readers of the "American Machinist." How useful they may be, I cannot tell. I suppose, however, the time has not gone by when men are liable to be called on to do odd jobs with poor facilities, and, no doubt, there are many machinists nowadays filling positions where, more or less frequently, in order to keep things running, they must do things not strictly in the line of machinists' work.

Our company owned and operated three blast furnaces, making charcoal iron; also eight or ten iron mines in various stages of development scattered over a territory of about one hundred square miles. The two old pioneer furnaces were located at Negaunee, and here we had a small machine shop equipped with a fairly good lathe of about 48-inch swing and 20-foot bed, an 18-inch lathe and a 40-inch drill press.

In this shop we did all the repairs for the furnaces and mines. There were three of us to do the work in the shop and the outside jobs at the mines and furnaces. We had no foundry, nor was there one nearer than Milwaukee, Wis. To keep up the repairs necessary for the various plants it was often necessary to have castings made quickly, and for this purpose we used one end of the pig bed in the casting house of the furnaces. In one corner we kept a lot of molding sand which was always ready for use. Many of the castings we made in open sand molds and others in flasks, always sinking the mold below the surface of the pig bed, to admit of a runner being cut from the main runner of the pig bed direct to the mold. Many a casting we made there, some good, some bad—more bad than good, if I remember rightly. We always took the precaution to make two or three molds of each piece wanted, particularly if we were in urgent need of the casting. None of us were molders, and

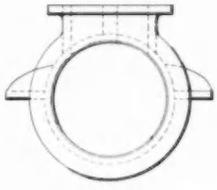


Fig. 2

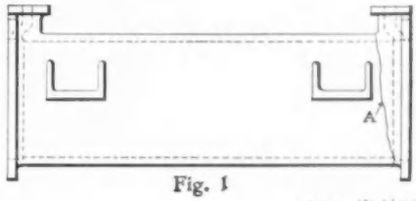


Fig. 1

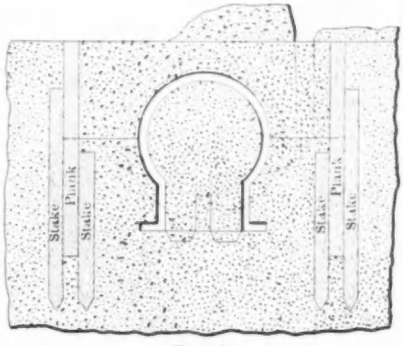


Fig. 3

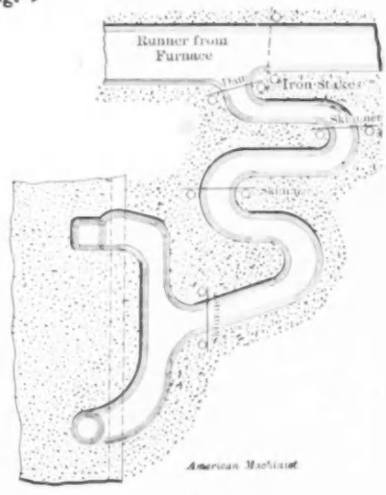


Fig. 4

THE BROKEN CYLINDER AND THE MOLD FOR A NEW ONE.

now, looking back, I can readily see that we were not first-class machinists, rated as machinists are now. We were young and energetic and perhaps undertook to do things that men of more experience would have laughed at, and, of course, we did make mistakes and often bad failures, but the manager seemed to overlook them and encouraged us to keep on trying.

The two young men associated with me were the best-natured and most willing I have ever met—nothing could scare them, and if nine, ten, twelve or fifteen hours per day would not accomplish the needed repairs they would work twenty-four hours without a murmur.

One of the blowing engines was a regular curiosity. The steam cylinder on this engine was 24x72 inches. (See Figs. 1 and 2.) While running, the piston broke at the end of the thread just inside of the nut holding the piston head in place. This must have happened just at the start of the piston toward the back end of the cylinder, forcing it with the full pressure of steam against the cylinder head, breaking the cylinder completely in two, as shown at *A*, Fig. 1.

The shutting down of a blast furnace at any time incurs great loss. Of course this is much greater when the stop occurs without preparation of any kind. We took great pride in keeping the engines running constantly, so that our weekly reports, when forwarded to the New York office, might show no shutdowns for repairs. This accident would probably cause a stop of days or even weeks, as the engine blowing the other stack was barely sufficient for its own work.

There were but two things that could be done. One was to send to Milwaukee and have a man come up, make measurement and get the work done there; the other, do the job ourselves, casting the cylinder in our makeshift foundry, using the melted metal from the furnace still running.

The manager reluctantly consented to let us go ahead. Our carpenter was put to work on sweeps, and the three of us went to work on the mold and cores and also on a mold for a boring bar and head.

We first dug out a pit deep enough to admit of forming the mold completely below the surface of the pig bed. We then set two 3-inch planks on edge, parallel with each other and far enough apart to admit of molding the cylinder with sufficient margin of sand on both sides. These planks served the purpose of guides for the sweeps. We made two sweeps—one the diameter of the outside of the cylinder, the other the diameter of the core. We first swept out the body of the cylinder and bedded in the flanges, then swept out the core prints and bedded in the parts forming the steam and exhaust ports and lugs. The cope half of the mold was swept out in the same way and both halves well dried with charcoal fires. The core was plain except for the port cores, which we made in a box, setting them into the main core. We dried the core with charcoal fires also.

The difficult part of the work was handling the cope and setting the core. This we did with a set of rope tackle, putting up a tripod and using what we called a crab winch to which we attached the tail rope. This served to handle the cope and core and also to lift the casting out when it was ready to be removed. Fig. 3 represents a section of the mold, and Fig. 4 a plan of the runner, showing dam and skimmers. The object of this form of runner was to clean the iron as much as possible before it entered the mold. We were about five days, of fifteen hours each, completing the mold for the cylinder. The mold for the boring bar was made in one day, and the bar cast at the midnight tapping of the furnace. When ready to cast the cylinder, we tapped the furnace and allowed 3 or 4 tons of metal to flow direct to the pig bed. We then lifted the dam, shown by Fig. 4, and set it across the runner at the dotted line. The long runner and the skimmers seemed to have cleaned the iron quite well, as we found a fairly good casting when it was pulled out.

We set the cylinder in the lathe with the stuffing box end next to the face-plate and faced it by using the compound rest bolted to the face-plate. The other end we did not face, as time was too valuable to waste in turning it end for end or to make a facing arm to use on the boring bar. In order to make a steam joint on this end we used a gasket made of braided hemp, about ½ inch thick by 1½ inches wide. This, with plenty of red lead putty, made a good joint. We had no way of planing the steam and exhaust nozzles. These we chipped and filed the best we could, doing it while the cylinder was being bored. We had taken the precaution, when making the mold, to have the lugs set sufficiently high so that they might be shimmed up to place, rather than to have to chip them. The job was complete in 172 hours and the furnace running.

The cylinder was not a handsome casting, nor was it as perfect as we wished, but it did the work for several years, and was still in working condition when the engine was thrown out and replaced by one of more modern design.

B. W. T.

The Shortest Way to an Iron Pattern.

Editor American Machinist:

The making of wheel patterns for various classes of machines where perfectly balanced wheels are required and where numbers of castings are wanted makes it necessary that a material more durable than wood be employed, and as the pattern must in most cases be first made of wood in order to secure an iron one, the less time and labor spent on the wood pattern, with due regard for the final result, the more satisfactory to all concerned. It is usual in many pattern shops to make complete wood patterns for such castings as shown in Fig. 1, and no matter how well the patterns are made it is sometimes necessary to mold several in order to secure a straight and true casting suitable for an iron pattern.

The method used in securing an iron pattern for the wheel shown, and for others of different design, does not lay claim to any originality, but it is more frequently used in molding large flywheels

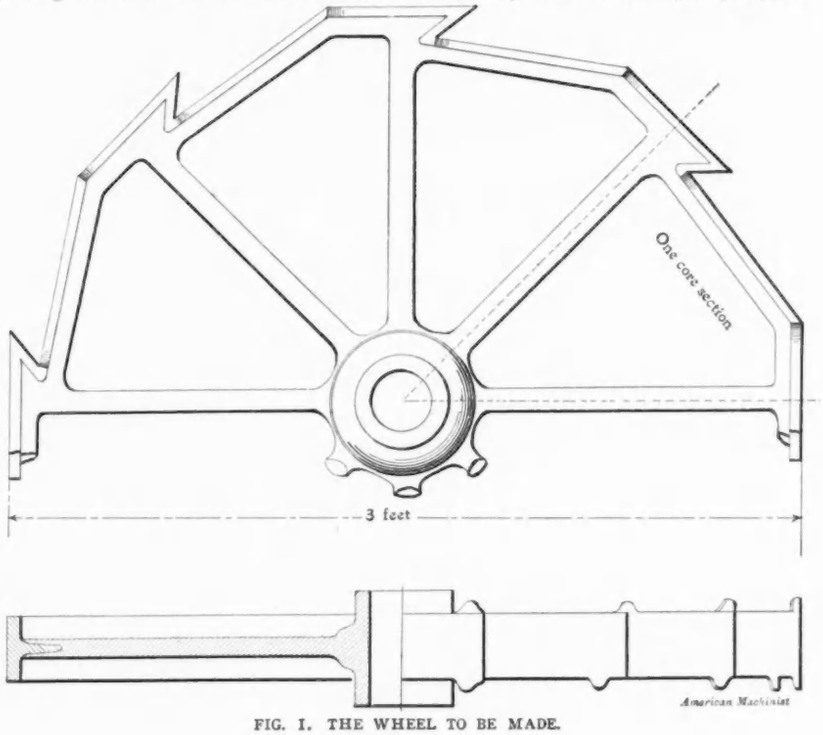


FIG. 1. THE WHEEL TO BE MADE.

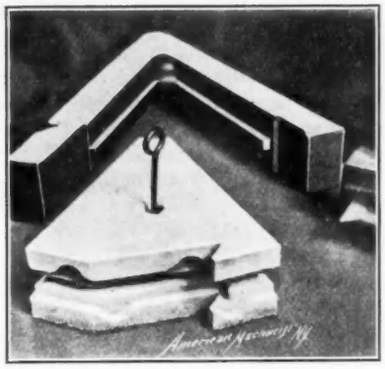


FIG. 2. ONE CORE AND PART OF CORE BOX.

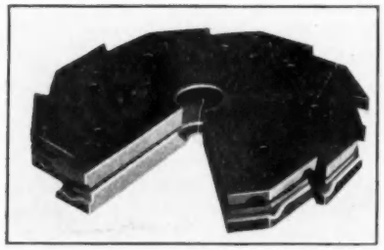


FIG. 3. THE ASSEMBLING OF THE CORES.

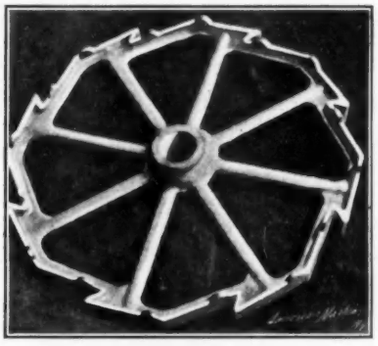


FIG. 4. THE CASTING.

and pulleys than on the small and delicate class of casting to which it is here applied. The patterns required to mold this wheel consist of a core box containing a one-eighth segment of the wheel, and an additional box to cover the outside face of the wheel.

In molding the wheel a perfectly flat and level bed is first made, of a few inches larger diameter than the wheel. The segment core box is rammed up in green sand, a board with half-inch clearance being first dropped into the box and a wood screw inserted as a means of lifting the segment on the bed. Fig. 2 shows a core ready for placing on the bed. The core box is stiffly made, and is in two parts, which are clamped together while being rammed, so that the very least amount of rapping is necessary. The cores being of green sand, the exact size and shape of the core box is obtained, which is not the case when the cores are of dry sand. Fig. 3 shows most of the cores set on the bed and also one segment of the outside face cores placed in position. When all the cores are set, a few weights placed around the outside and on the top of the segments, and the center core set true and covered with a piece of core, the mold is ready for pouring. Fig. 3 shows the casting, which is as true and straight as could be desired. The cost of the pattern is less than one-half that of a complete pattern, and the time taken to mold the casting is the same as when made with a complete pattern. GEO. BUCHANAN.

Wrexham, North Wales.

Jig For Boring Twin Cylinder Castings.

Editor American Machinist:

I send you a drawing of a jig designed for machining the cylinders of automobile steam engines. A sketch of the cylinder casting is given up at the left. The diameter of the cylinders is 2½ inches and of the valves 1¼ inches; length, 5¼ inches. The work was done on a 22-inch back-geared drill, which was light for the job. The time required to finish the four holes was about four hours. The jig was designed to machine twenty-five cylinders. The cylinders were planed top and bottom before boring.

The base of the jig *A* was bolted to the drill press table with the hole in the bushing in line with the spindle. The upper portion *B* was then slid on. To place the cylinders in position lift the strap *C* in front, slide the cylinders in against the stop screw *D* at the back, swing the front strap back and set up the screw in the center. Bring up the right gib *E* by means of the two screws, and tighten down the two top screws. This holds the cylinders firmly in the jig. The left gib *F* and the stop screw *D* at the back are not moved after the first cylinder is properly located. There are four holes in the side of the sliding portion *B* located at the proper distances for the four holes, into which the pin *H*, shown on the right side, fits. After the pin is located in the desired hole the gibs *I* should be tightened down.

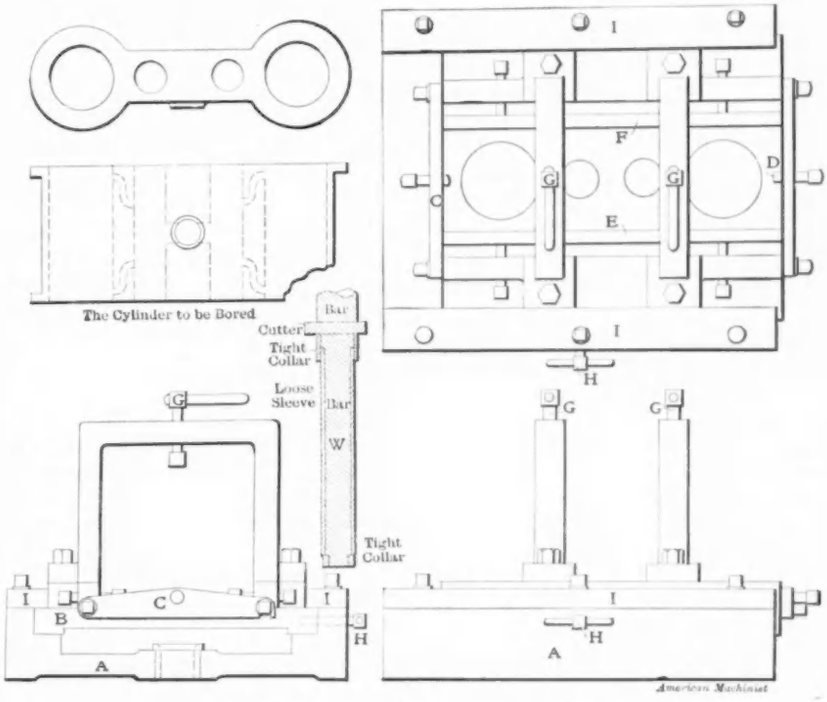
For the roughing cut a plain boring bar was tried, but the fine iron dust troubled some by working between the bushing and the bar. A leather washer fitting the bar tight and fastened over the bushing protected the bushing from chips as much as possible. The bar with the loose sleeve shown at *W* was used with perfect success. The sleeve slid through the bushing as the bar fed down, all the revolving being inside the sleeve, which has the upper end entirely protected from chips and dirt. The roughing cutter was made of 7-16 inch square self-hardening steel, one end longer than the other, the short end slightly in advance or lower on the vertical bar to divide the cut. A second cut was made with a rose reamer mounted on a similar bar, and the hole was finished by reaming with a loose reamer. The valve holes were done in a similar manner, a smaller bushing being placed inside the larger in the base *A* for that operation.

A. F. WISNER.

A Micrometer for Screw Threads.

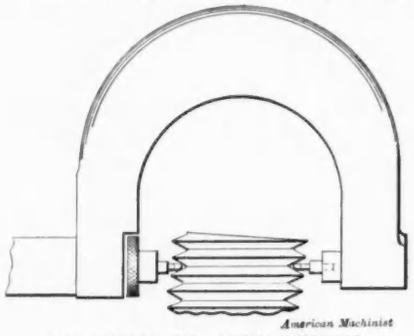
Editor American Machinist:

The first micrometer of the type with which we are now familiar was apparently made so nearly right that it has not seemed worth while to change it after mechanics have become so accustomed to its use. I suppose that if the screws had been cut originally 25 or 50 to the inch, instead of 40, the other divisions being made to correspond, the tool would have



JIG FOR BORING TWIN CYLINDER CASTINGS.

been just as satisfactory. And so when we propose an improvement, it behooves us to make haste slowly in order that the improvement may become, like the micrometer itself, a permanency. The device I have here in mind is for accurately measuring screws; and, without reflecting on the efficiency of other devices, I will say that this is a practical, satisfactory device, and so decided in a large screw-manufacturing concern after experimenting with everything known in this line. It is nothing but a pair of spherical points attached to a standard micrometer. These points find a bearing just where the nut should fit on the screw. If we have a nut and bolt perfectly fitting each other, and proceed to take a cut off the outside of the bolt, we can't observe any difference in the fit; so that we find very often that the diameter of the bolt outside or the diameter of the nut inside cuts a very slight figure in the fit. What we propose is to have sets of spheres, of standard sizes, with standard projections from the face of the anvil. The spheres should be so large as not to strike the bottom on a standard screw, and small enough to go



MICROMETER FOR SCREW THREADS.

below the top of the "V." I estimate that one pair of spheres will answer for five or more pitches, and by having all fitted alike we take in fine threads of large diameter for bicycle work and all odd sizes within the limits of our tools. Then if there was not too much of an opening in the anvils, the micrometers could be used for ordinary work as well. The size when the spheres are in place *properly* should be stamped on each.

The usual custom in screw factories is to have a set of hardened and ground gages, and when making taps, to take the size from the gages with the spherical-point micrometers. Now, if it was known what these sizes were, it would not be necessary to have the gages. These gages are so expensive as to debar all except the largest companies from enjoying the luxury. A maker of micrometers could get up an index giving all these sizes for standard screws, and all screws could be ordered by these micrometers thus:

Nominal size	"V" thr. per inch.
½ inch	13

Bearing size measured with No. 5 points, .627.

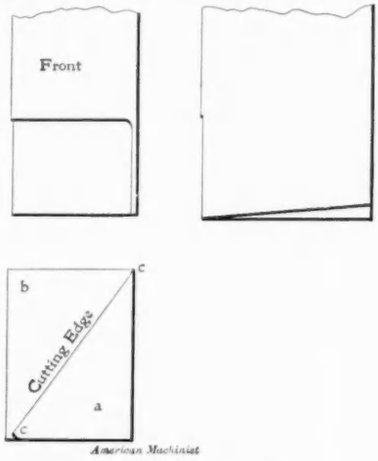
It would not be really necessary to mention No. 5 points, as each would have an index stating what pitches each pair of points was adapted to; and, they being all alike, the man in Kalamazoo would measure exactly like the man in Providence.

ISAAC MORGAN.

Oblique Lip Planer Tool.

Editor American Machinist:

This tool is designed to take the place of the ordinary twist-lip planer tool, and has the advantage of being able to take



OBLIQUE LIP PLANER TOOL.

from four to five times as coarse a feed as can be done with the usual twist-lip tool, and, besides, needs no forging. Take a piece of tool steel and face one end of it off perfectly square with the back. Cut off one half of the stock, as at *b*, for a hight of about one inch. File clearance of part *a* so as to just clear the work. Round corners *c c* a very little. The clearance of the back part of the tool will have to be varied slightly on different stock, more for some than others.

Y.

Screw Machine Tool-Holders.

Editor American Machinist:

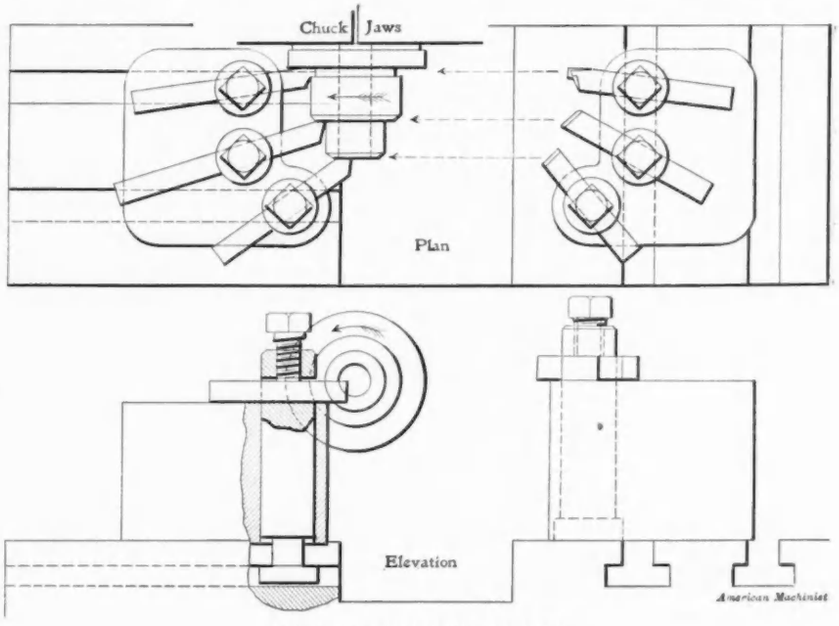
The tool-holders here described and illustrated are intended for use on the cross-slide of a screw machine. They are adapted for work where there are several shoulders to face down or other operations to perform for which a single post would not be adapted. The illustration shows how the holders are applied and used, making an extended description unnecessary.

The blocks are made of cast iron, the holders of soft steel, the set-screws of cast steel with only the heads and points hardened, while the tools themselves are made of self-hardening steel broken into lengths of 4 or 5 inches. The block intended for the front of the slide should be made of such a hight as to bring the upper edge of the tool on center, and the back block should, as is shown in the illustration, bring the *lower* edge of the tool on center to avoid the necessity of reversing the machine. In each case two of the holders are extended down into the slots in the cross-slide to hold them in place on the machine.

As a usual thing the tools are arranged the same on both blocks, one set taking the roughing cut and the other the finishing cut; but in cases where only one cut is required, as on two of the shoulders on the casting shown, other operations may be performed.

By means of this device the tools are held rigidly, are quickly and accurately adjusted, a great range of work can be covered with few tools, many moves are saved on the part of the operator, the steel tools do not have to be machined or forged, the cost of equipment is kept low and the turret is relieved of part of its load.

ROGER HAINES.



SCREW MACHINE TOOL-HOLDERS.

Strength of Flat Cover Plates.

Editor American Machinist:

The writer wishes to call attention to Mr. Jones' formula, in issue No. 23, for flat plates, which is evidently a misprint, although the statement of the method is correct, and is approximately the one the writer is accustomed to use for cylinder heads. The general formula is:

$$T = \frac{D\sqrt{p}}{\sqrt{6\,s}}$$

where

T = thickness of the plate,
D = diameter if round, or shortest side if rectangular,
p = working pressure,
s = safe unit stress.

Assuming the ultimate tensile strength of cast iron as 20,000 pounds per square inch and with a factor of safety of 8, the formula becomes:

$$T = \frac{D\sqrt{p}}{\sqrt{15{,}000}}$$

or more conveniently stated,

$$T = .00819\,D\sqrt{p}$$

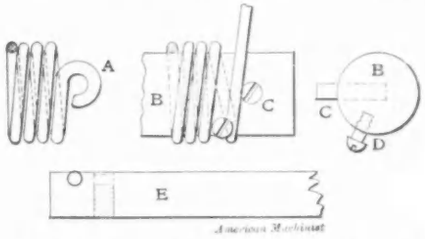
Examples in actual practice agree very closely with the above formula. The average value of the numerical constant may be perhaps slightly less than the value stated. H. W. POTTER.

[The denominator in Mr. Jones' formula should have been 120, not 220.—Ed.]

Making an Eye on the End of a Spring.

Editor American Machinist:

I was given some steel springs just as they had been wound in the lathe and told to form an eye A on them to take a No. 14 machine screw. The springs were made of No. 6 tempered steel wire and were about 1¼ inches inside diameter. I was told I would have trouble in bending them, and that other parties had to



MAKING AN EYE ON THE END OF A SPRING.

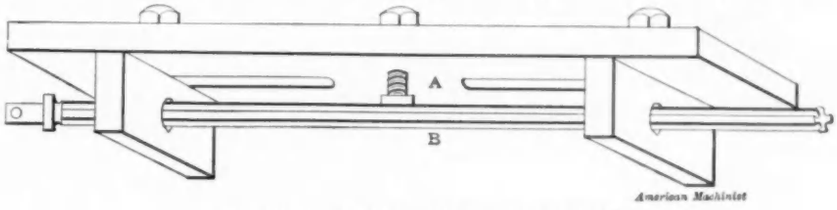
heat the end and bend while hot. I didn't think that suited me very well, so I took a piece of ¼-inch round steel B, drilled a hole for a ¼-inch pin C, and a hole for screw D; then, straightening about one inch of the end of the spring and putting it on the piece B, I spread the coils enough to put in the screw D, and screw it down tight. Then a piece of flat iron E, with a hole as shown, was slipped over the end of the wire against pin C, and then a turn of E around the pin finished the job, except that the ends had to be cut off so as to just complete the eye, and it was then pressed down flat; all done cold and in less time than it takes to tell it.

E. P. J.

Straightening Reamers After Tempering.

Editor American Machinist:

I send you a sketch of a device for straightening long reamers that have been sprung in hardening. It is a very difficut job to temper 1 to 1½-inch reamers, 30 inches long, and keep them straight. The toolsmith says it cannot be done.



STRAIGHTENING REAMERS AFTER TEMPERING.

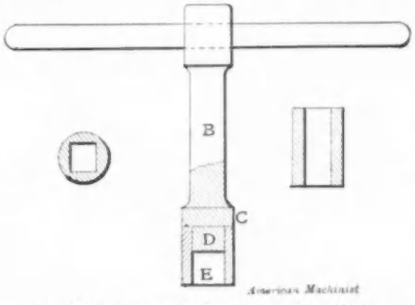
Well, my device will always correct them. The reamer which has been sprung in hardening is placed in the clamp as here shown, with the convex side towards the set-screw A. Then the side B is heated by a gas blower, at the point where it should come over, and the set-screw is tightened until the reamer is bent sufficiently in the opposite direction. Then soap is applied to the side heated, and the reamer is left in position until cooled off in water. In this manner I have been able to straighten all the bent reamers that I have tried. F. W. ROEBBEL.

Mo. Pac. Ry.

Making a Square Socket Wrench.

Editor American Machinist:

The sketch shows an economical way of making a chuck key. I have often seen machinists make it in one solid piece, necessitating much chipping and punching at a blind hole in their endeavor to cut out the square. I think a good way is to make



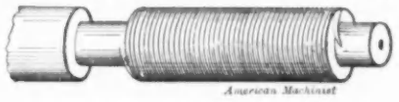
MAKING A SQUARE SOCKET WRENCH.

first the sleeve A independent of the rest of key B. Bore out a suitable piece of stuff, then file out flats and finish with a suitable drift. Then proceed with the body of the key B, leaving a shoulder at C for the socket to bed against when in place. Also turn D the size which A is across the corners of the hole. Then dress this part square. It should fit A a good driving fit. When it is driven on you have a quicker made key in the first instance, with the additional advantage of quick repair. As most keys break at the point E all one has to do is to knock off A, replace with another socket on body B and it is as good as ever, at a very slight cost. J. HOLLOWAY.

An Inconvenient Shaving.

Editor American Machinist:

A young machinist was frequently experimenting with tool grinding. He knew



AN INCONVENIENT SHAVING.

rake from clearance, positive from negative, and he designed, ground and used the tool that produced the shaving of which I send sketch. The tool appeared to be similar to a side or facing tool. The material cut was a piece of very tough cold-rolled shafting. I regret to have to add that to remove the shaving it was necessary to use hammer and chisel, it was so tightly wound. F. B.

Letter From a Practical Girl—We Should by all Means Have Said "Bad English."

Editor American Machinist:

It seems to be a fad in this day and generation for everybody to call everybody else down, and I take the liberty of calling your attention to the editorial on page 678 of the "American Machinist," the article being headed "Not Only a Machinist but a Westerner." No doubt your criticism is a good one, as there is too much literature at the present time that is "silly and tiresome," and that, too, published by the best people. However, you say therein that "he used bad grammar," also that "Century Magazine" "workingmen must always speak bad grammar." I want to ask if there is such a thing as "bad grammar," and would it not have been more correct to have said "bad English"? Grammar is the "art of reading, writing and speaking language correctly," and how could it be other than correct? This is a common error I find, and is something that I had to learn also, but I always like to

know the correct thing, and am willing to be criticised in order to be more perfect. You will take the above in the spirit in which it is written.

I always read the "American Machinist" with much interest, enjoying a very great deal everything therein.

I know your paper is not a matrimonial agency, but I wish it were possible for me to convey my appreciation of "Mechanic" to him. His letter was good, and I wish more young men would emulate his ambitions. I am sure the "good girl" in question has not been "cheated out of a home," but, on the other hand, "some good girl" will have a *better* home thereby, and I think two people will be happier and the world that much better because he was not satisfied to be *anything*, but aimed to be *something*. Your paper is fine and I urge my friends to read it, and to take it. LIDA M. BROOMALL.

Bridgeton, N. J.

Making Teeth for Gear Patterns.

Editor American Machinist:

Mr. E. S. Newton in a letter under the above title in No. 23, works himself into a fine frenzy over that part of my letter, "The Band Saw in the Pattern Shop," in No. 18, where I had the temerity to question the accuracy of a gear wheel with the teeth made in a former and glued to alleged center lines as advocated by M. Richardson and others, which apparently includes Mr. Newton from the very earnest and able manner in which he so warmly defends this method that needs defending so badly.

Mr. Newton, after telling us about that remarkable patternmaker of his, gets facetious and describes a method, dating from the stone age, I think, of making gears by dovetailing the teeth on the rim and cutting taper dovetails under each tooth, and I fear that he was cruelly deceived by my letter into the belief that it was the way practiced by yours truly when making gears of any kind.

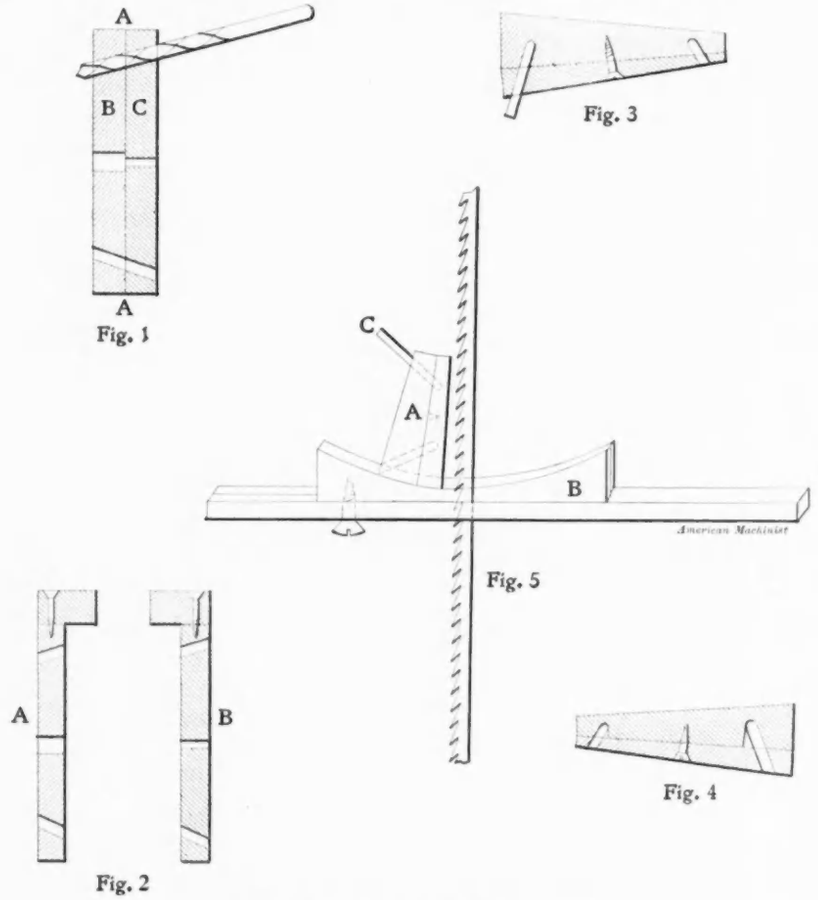
Now, if he will carefully read my letter, he will notice that I make spur gears of all sizes on the band saw after gluing the teeth stock solidly to the rim and laying out one side only *accurately*, the saw doing the rest, and doing it right, too, and that lets the spur gear out of this little discussion. If he will read a little further he will see that I also cut bevel and miter gears on the band saw after the teeth have been *dovetailed* in place, the face and ends turned and laid out on the inside or small end of tooth, and he cannot hold me responsible if his understanding of the word dovetail is decidedly hazy, but perhaps it's up to me to enlighten him by explaining just what I meant by dovetailing bevel or miter gear teeth on the rim and its decided advantage over the "former and gluing to line" method used by his patternmaker and exploited by himself and others in the columns of the "American Machinist."

By our method, after the rim has been turned and spaced off on the face with center lines (and they are center lines as they point to a common center), we use these lines as a guide for a drilling jig shown partly finished only in Fig. 1 and complete in Fig. 2 at *A*. With this jig we drill three holes—one for a screw and two for dowels—clean through the rim. The two holes for dowels are drilled at an angle of 15 degrees right and left as far apart as the length of tooth will allow. We also drill holes in the teeth by a jig—shown partly finished in Fig. 1 and complete at *B*, Fig. 2—to match those in rim. The two sets of holes form what is called, in our shop at least, the pin dovetail, and by it we are enabled to turn face and ends of teeth, and it is a dovetail just as much as the commonly accepted type. Mr. Newton may ask why the holes are not drilled parallel to each other, and that's where the little joker comes in—as we use the pin dovetail to lock the teeth without the aid of a screw in the sawing jig—shown in Fig. 5 at *A*.

This is an easy, quick, and sure method of holding the teeth rigidly while being subjected to the thrust of the band saw, and also of fastening the teeth to the rim in their relative positions re-enforced by glue and screw, with the exception of two or three that are purposely not glued on and are used for mending the mold if necessary. These are so marked by the usual ring around the screw head in the back—and I might mention in this connection that the teeth used for mending have the inside "lock" of the pin cut away, as shown in Fig. 4, so as to be removed easily when wanted.

As a further explanation of sketches seems to be in order would say that Fig. 1 represents the two drilling jigs jointed at *A A* drilled and sometimes bushed with brass tubing if a great number of teeth are to be used. It will be noticed that the center holes are of two diameters, that for the teeth *C* to the size at the bottom of thread of screw and that for the rim *B* to the size of outside of same. After putting on guide ends, as shown in Fig. 2, the jigs are ready for business. Fig. 3 shows section of tooth and rim with outside pin to be pulled out after removing screw so as to place same in sawing jig, Fig. 5, which shows a tooth in position to be sawed on one side only with the table tilted to the desired angle and the bottom part *B* secured to the table through the medium of a screw in the saw slot and pin *C* to be pulled out after completion of cut. *B* and *A* are never less in width than four times the thickness of tooth.

I beg to assure Mr. Newton that the lines on the face of rim on all bevel and miter gears, unless skewed, certainly should point to a common center, and if he chooses to attempt the trick of gluing



MAKING TEETH FOR GEAR PATTERNS.

the edges of his teeth to these lines it doesn't alter the fact that they still remain center lines. I am *very* sure that he is greatly mistaken when he makes that wild claim that he could cut the time of making gears as we do in half twice by using his method, and I court an opportunity to prove that for *accuracy*, finish and speed our method so far excels his that a comparative test would be very disconcerting to the disciples of his belief and would show that there are ways of making gears that would even surprise him and his patternmaker. "OLD BOB."

A Small Job.

Editor American Machinist:

Computing scales, such as are used in the retail trade, are frequently provided with turntables, for convenience in turning them so they can be operated from either side or end of counter. To avoid marring the counter upon which they are placed, rubber-tipped, adjustable foot-screws are provided, which are used also as leveling screws.

When the sales department sent us several complaints about the tips becoming loose, we thought it was merely a matter of procuring better cement or better care in applying it; but becoming convinced, after experimenting, that the method of cementing was impracticable, it was decided to try the Hibernian way of "cementing, by not cementing at all."

Believing it could be done rapidly and effectively by a "coaxing" or swedging operation, the rig shown in the sketches was made to be used on the bench, as no press was available.

In Fig. 1 are shown plan and side views of tip, molded to just fit recess in head of screw, as shown in Fig. 2, and in which they had been cemented. In Fig. 3 is shown the coaxer *B*, of tool steel, having a taper hole large enough to just allow the head of screw with tip inserted to enter, and a cast-iron die-block *C* having a hole into which the body of screw fits loosely. *D* is a bench plate on which *C* rests. A light hammer blow on upper end of *B* gives the shape shown in Fig. 4.

The whole apparatus could have been made more elaborate and artistic, mechanically, but——

A. B. CHRISTMAN.

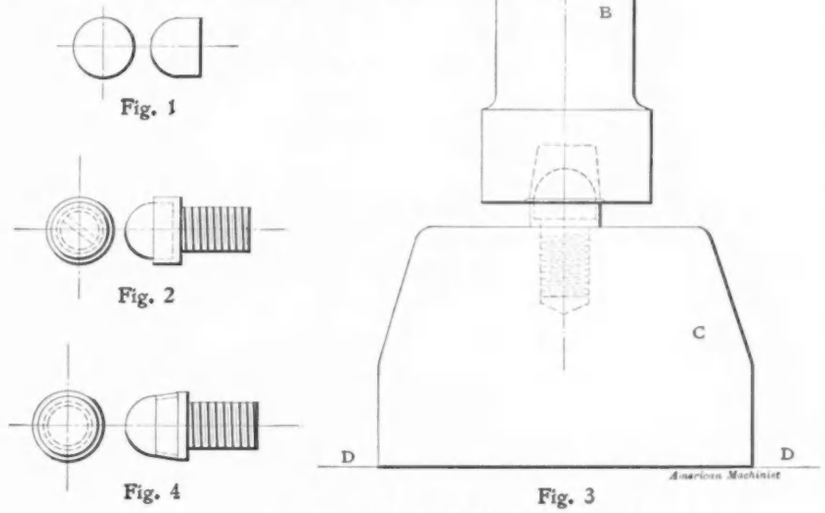


Fig. 1 Fig. 2 Fig. 4 Fig. 3

A PAIR OF DIES AND ITS WORK.

Miscellaneous Wants.

Advertisements will be inserted under this head at 25 cents a line, each insertion. Copy should be sent to reach us not later than Saturday morning for the ensuing week's issue. Answers addressed to our care will be forwarded.

Gear Wheels, gear cutting. Grant; see p. 34.

Caliper cat. free. E. G. Smith, Columbia, Pa.

Punches & dies. Wal.M.Wks., Waltham, Mass.

Wanted—Improvements in grinding machinery. Address Box 1435, Providence, R. I.

Light and fine mach'y to order; models and elec. work specialty. E. O. Chase, Newark, N. J.

Book "Dies and Diemaking," $1, post paid. J.L.Lucas, Bridgeport, Ct. Send for index sheet.

"Brandt's Triple Expansion Gaskets" are the best for boilers. Randolph Brandt, 38 Cortlandt st., New York.

Wanted—Copy of the "American Machinist" of Oct. 4, 1900. Address "A," P. O. Drawer 5094, Boston, Mass.

See 12 presses & dies for sheet-metals, S. E. cor. Machinery Hall, Buffalo Exposition. Ferracute Mch. Co., Bridgeton, N. J.

Wanted—A good second-hand electric locomotive. Address, with particulars and price, P. O. Box 2023, Bridgeport, Conn.

For Sale—1 Riehle 200,000 lb. testing machine, 1 Riehle 10,000 lb. testing machine. For particulars and prices apply to J. Adriance Bush, 100 Broadway, New York City.

Gear and Milling cutters, adjustable reamers and special tools; vertical millers, cutter and surface grinder and shears. Catalog of small tools free. R. M. Clough, Tolland, Conn.

Purchaser for small manufacturing plant; lot, 100x180 ft.; machine shop, 32x68; two story, with line shaft and gasoline power; foundry, 40x54, new modern equipment; good location; for sale cheap. Hart-Parr Company, Madison, Wis.

Institutions retiring from business having machine tools, brass and wood working machinery will find it to their interest to correspond with us. We purchase complete plants or handle them on com. C. C. Wormer Mach. Co., 55-59 Woodbridge st., W., Detroit, Mich.

"No junk at half price sale."—On account of other interests needing my attention, will sell one of the best equipped foundry and machine shops in the best city for business and health in Texas for $25,000; $5,000 cash; balance, 1 to 10 years. R. W. Lewis, 222 Garden st., San Antonio, Texas.

Set of Bound Volumes for Sale.—We have for sale a set of bound volumes of the "American Machinist" from Vol. 3 to 18, inclusive; all in good condition; ten are bound in morrocco and six in cloth; leather-bound volumes have name of a former editorial writer on side; cloth-bound volumes unmarked; the entire set for sale at $4 per volume; a chance not often found; first order takes the books. AMERICAN MACHINIST PRESS, 218 William st., New York. (P. S.—One volume of Vol. 8 for sale at $2.)

Wants.

Situation and Help Advertisements only inserted under this head. Rate 25 cents a line for each insertion. About six words make a line. No advertisement under two lines accepted, and no advertisements abbreviated. The cash and copy should be sent to reach us not later than Saturday morning for the ensuing week's issue. Answers addressed to our care will be forwarded. Applicants may specify names to which their replies are not to be forwarded; but replies will not be returned. If not forwarded they will be destroyed without notice. Original letters of recommendation or other papers of value should not be inclosed to unknown correspondents.

Situations Wanted.

Mechanical draftsman wishes position. Address Box 255, AMERICAN MACHINIST.

Draftsman, good designer, shop experience, desires position. Box 265, AMER. MACHINIST.

Mechanical draftsman, experienced, wishes position. F. G., Box 277, AMER. MACHINIST.

Position as superintendent or general foreman by up-to-date, practical mechanic. Box 264, AMERICAN MACHINIST.

Mechanical draftsman and designer wishes position; New England or Eastern New York preferred. Box 276, AMERICAN MACHINIST.

Young German, practiced 1½ years in engine tool works and has 4 years' technical training, desires suitable position. Box 216, AMERICAN MACHINIST.

Position as superintendent or foreman of machine shop building high-class interchangeable work; young, energetic, ingenious, good disciplinarian; best references. Box 274, AMERICAN MACHINIST.

Machinist foreman, up-to-date hustler and capable of handling men to best advantage and reducing costs by labor-saving devices, desires suitable position. Box 273, AM. M.

Mechanical engineer, graduate, experienced in designing complicated automatic machinery and building same, is looking for engagement in or near the city. Box 266, AM. M.

Mechanical engineer, of practical experience from the power plant to production, as foreman and master mechanic, solicits correspondence. Box 239, AMERICAN MACHINIST.

Position as superintendent; capable of handling men to a good advantage and reducing costs by labor-saving devices; will purchase interest in a reliable concern. Box 177, AMERICAN MACHINIST.

A thorough, up-to-date machinist of practical inventive ability, good designer, well experienced, systematic, used to take charge, wants suitable position to make full use of his ability. Box 244, AMER. MACHINIST.

Situation wanted by all-around, practical foreman blacksmith; thoroughly familiar with steam and drop hammers, case-hardening and tempering, etc.; reliable man; references. Address B, 2087 Dean st., Brooklyn, N. Y.

Experienced engineer open for engagement as superintendent, assistant superintendent or chief draftsman; 18 years' experience, covering machine tools, electrical machinery and rolling mills. Box 240, AMER. MACHINIST.

Position as superintendent or general foreman; am conversant with the machine business in all its branches, a designer of tools, jigs and modern appliances for economical production. Box 217, AMERICAN MACHINIST.

Engineer's License.—Machinists, engineers, firemen, electricians, etc.; 40-page pamphlet containing questions asked by Examining Board of Engineers sent free. Geo. A. Zeller, Publisher, Room 336, 18 S. 4th St., St. Louis, Mo.

Mechanical engineer, with technical education and many years of varied experience in office, shop and outdoor work, is open for engagement 1st of August, as designer, chief draftsman or superintendent. Box 267, AMERICAN MACHINIST.

An American, thorough mechanic, large experience handling men to advantage, well posted in economical methods and all up-to-date shop practice, wishes position as superintendent or assistant superintendent. Box 262, AMERICAN MACHINIST.

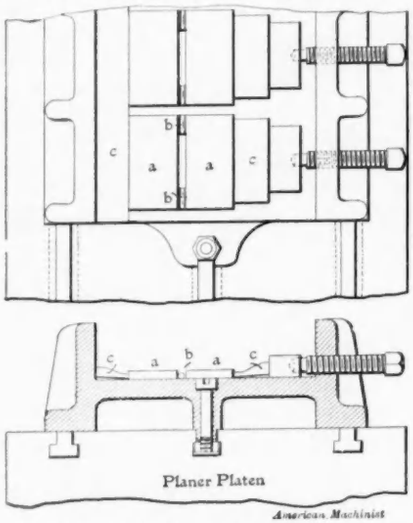
Practical man, up to date (non-union), technical educated, energetic and organizer, 15 years' experience as foreman and con-

(*Continued on next page.*)

Holding Down Flat Pieces on the Planer.

Editor American Machinist:

I enclose a sketch showing an addition to the well-known angular hold-down pieces for preventing planer work from lifting when clamped edgewise. The pieces to be planed *a* are arranged in pairs with short pieces of wire *b* between the pieces of each pair. The hold-down pieces *c* are rounded at the thin ends, and the angle between the bottom and the thick edges is



HOLDING FLAT PIECES ON THE PLANER.

from 1 to 2 degrees less than a right angle, and it is only necessary that the diameter of the wires *b* should be somewhat less than that of the rounded ends of the pieces *c*. They may be pieces of wire, drill rod, wire nails with the heads cut off or "any old thing." R. A. NIVEN.

Quick Annealing—Cross Lines on Planer Platen—Fastening Flat-Head Screws.

Editor American Machinist:

Once in a while it happens that we want to use an old hardened punch or some other piece of steel in a great big hurry and can't wait for it to anneal in lime. In order to get it in a workable condition quickly give it a water anneal; but here's the way to do the trick. Simply heat the piece to a dull cherry red; then have a piece of soft pine handy, and as it cools try the heat by charring the wood. When the heat gets so slow that the piece *will not char* the wood plunge it quickly in oil. You will be surprised to see how soft it will become.

Do you know it's a great convenience to place marks crosswise of your planer and milling machine platens, say every 6 inches apart? You'll be surprised to see how handy they are for various jobs, also for setting angle plates.

A good way to prevent flat-head machine screws from backing out is to simply center punch the metal into the ends

(*Continued on next page.*)

(*Continued from preceding page.*)

structor in mechanical and electrical works and modern shops in Germany, desires position. W. K., care AMERICAN MACHINIST.

Superintendent of a large, progressive machine works, wants a change; 15 years' practical experience; technical education; good management should pay its own salary; will accept position on these conditions; can earn salary, or don't want it. Address Box 261, AMERICAN MACHINIST.

A thoroughly practical, up-to-date foreman, 36 years old, with exceptional ability, is open for an engagement; can handle large force of men, organize a shop on paying basis; would accept position as assistant superintendent; best of references; correspondence treated confidentially. Box 263, AMER. MACHINIST.

Wanted—Position by an assistant superintendent; can organize and handle men successfully; can furnish best of references; of sober habits; understands general and latest shop practices in all branches, also toolmaking in all lines; would like to engage with company doing light interchangeable work; at liberty July 15. Address Box 275, AMERICAN MACHINIST.

Change of position desired, technical educated civil and mechanical engineer, 15 years' practical experience, several years in charge of construction and erection, 6 years chief engineer of engine and boiler and general engineering works; designed and built several hundred simple and compound Corliss and other engines, air compressors, hydraulic, pneumatic and electric cranes; steel frame and other shops, with profit to employers and satisfaction to users; have had some experience with marine machinery; own good instruments; member of several technical societies. Address "Hard Worker," care AM. M.

Help Wanted.

Wanted—Wood pattern makers; steady job. Gardner Governor Co., Quincy, Ill.

Wanted—Two first-class operators on Gisholt turret lathe. Box 185, AMER. MACH.

Wanted—Experienced men for responsible positions. Address James Brady, 220 Broadway, New York.

Wanted—Mechanical engineer having experience in Corliss and blowing engines. Box 258, AMERICAN MACHINIST.

A mechanical draftsman wanted for special machinery. Address, with references, age and salary expected. Box 227, AMER. MACH.

We solicit applications from reliable machinists; state references and experience. Address Box 256, AMERICAN MACHINIST.

Wanted—A man who thoroughly understands making dies for sheet iron work. Address "Die Maker," care AMER. MACHINIST.

Competent machinery designer, preferably with experience in building presses and tools for sheet metal. Niagara Machine & Tool Works, Buffalo, N. Y.

Experienced mechanical draftsman wanted for out-of-town position; applicants must state age, experience and salary required. Box 257, AMERICAN MACHINIST.

Wanted—First-class traveling salesman to sell special wood-working machinery; will pay first-class wages to proper man. Address Box 269, AMERICAN MACHINIST.

Good patternmakers, both wood and metal, desiring steady employment, will find it to their advantage to apply to the General Electric Co., Schenectady, N. Y.

Wanted—First-class machinists, lathe hands and metal pattern makers; state age, single or married, references and wages expected. Box 268, AMERICAN MACHINIST.

We invite applications from machinists and molders; give references, experience and wages expected; work on air compressors. Franklin Air Compressor Co., Franklin, Pa.

Wanted—Machinists to work in shop in Western Pennsylvania building engines and general machinery; lathe and planer men preferred; give age and experience. Box 251, AMERICAN MACHINIST.

Wanted—Competent draftsman with experience in designing Corliss engines, air compressors and mining machinery; state age, experience and salary expected. Box 270, AMERICAN MACHINIST.

Wanted—Two or three first-class toolmakers familiar with gage, jig, cutter and fixture work; state age, wages expected and class of work most familiar with; work day 10 hours. Box 259, AMERICAN MACHINIST.

Wanted—A first-class, all-around machinist, for both machine work and assembling, eventually to take charge of work; give full details of age, experience, nationality and wages expected. Box 272, AMER. MACH.

Machine shop foreman; an experienced machinist and good handler of men; must be steady and reliable; give age and references; also good machinists on lathe work. Apply, at once, Petersburg Iron Works Co., Petersburg, Va.

We are enlarging our works, and will shortly require an increased number of skilled mechanics; we invite application from pattern makers, molders and machinists. Address the Westinghouse Machine Company, East Pittsburgh, Pa.

Machinists, lathe men and assemblers wanted in a New England shop that has not laid off hands in years; healthy location, good work and wages. Give name of last employer, or send recommendation to Box 254, AMERICAN MACHINIST.

Wanted—Foundry foreman, by up-to-date foundry in Central Western city employing about 25 molders on high-grade medium and heavy machinery castings; good salary and permanent position to competent man. Address, giving experience and references, Box 271, AMERICAN MACHINIST.

Wanted—Experienced foreman for lathe department, containing thirty 14 to 20 in. lathes, by an established concern building a great variety of high-grade special machinery; all work made from first-class drawings; permanent position and good pay to the right man; reference required. Box 234, AM. M.

Wanted—An experienced foreman in gasoline and oil stoves, to take charge of machine shop, press and die room, capable of designing and handling dies and pushing through work at lowest cost and lots of it. Apply by mail, giving age, experience and reference, The Monarch Stove & Mfg. Co., Mansfield, O.

Wanted—Experienced man as working foreman to take charge of milling job in machine shop having several universal, plain and vertical machines; must be able to work from drawings and handle help advantageously; permanent position and good pay to the right man; reference required. Box 235, A. M.

Wanted—Draftsman.—Thoroughly competent designing draftsman, one experienced on high-class engine work preferred, by large works near New York city; likely steady position to right man; state age, particulars of qualifications, how situated and salary expected to start with. Address Box 260, A. M.

A successful manufacturing concern desires to add another department, where its foundry, machine, smith, pattern and carpenter shops can be utilized; a man of energy and brains will receive a growing salary and encouragement in developing and managing any meritorious specialty; correspondence solicited; strictly confidential. Box 233, A. M.

Wanted—General shop superintendent for bolt and nut works in Australia; moderate sized plant; equipped with new American tools; must be competent draftsman, energetic and have executive ability; if capable of filling the position will be made manager; give full experience and references. Address Cleveland Twist Drill Co., Cleveland, Ohio.

Wanted—A first-class machinist foreman to take charge of small machine and interchangeable work in established shops manufacturing instruments of precision; must have up-to-date ideas of manufacturing rapidly and well with modern tools and first-class executive ability in handling men; good opening for the right man; state age, experience, salary desired and give references. Box 232, AMERICAN MACHINIST.

WANTED—Die Sinkers, 9 hours work daily, steady employment. Only first-class men, accustomed to drop-forging work, need apply.

J. H. Williams & Co.,
9 Richards St., BROOKLYN.

Draftsmen Wanted.

We have positions open for capable, experienced Mechanical Draftsmen. Our business is to assist Draftsmen and Engineers (technical men only) to secure positions when unemployed, and to better their positions when employed. Our business was established in 1893.

No registration fee. THE ENGINEERING AGENCY, 1605 Monadnock Block, CHICAGO.

Wanted Instructor in Machine Design.

In a technical school in the East, on account of increased size of classes. Applicants must be graduates of good engineering schools, with considerable experience in practical machine design of machine tools, steam engines or similar work. Salary, $1,200 first year. Address, giving age, experience in detail and list of references, "Machine Design," care AMERICAN MACHINIST.

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MAGNETIC SEPARATOR

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Brass stock cleaned with this machine can be used for best work. Machine will pay for itself in labor saving alone.

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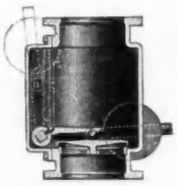

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This valve has no dash pots, springs, guides or complicated levers to get out of order. It is simple, reliable and well made. Never sticks, and can be relied upon at all times when using exhaust steam for heating; or when used as a relief, or free exhaust on a condensing plant, it has no equal. It is noiseless and free from any complicated attachments.

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(*Continued from preceding page.*)

of the slot. Hold the punch on a slant toward the screw head.

B. LACHMANN.

The American Locomotives on the Midland Railway.

A prominent topic of discussion in English exchanges that have recently reached us is the report of the trial of the Baldwin locomotives that were put at work some time ago on the Midland Railway. Records being kept, it was shown that the American engines consumed 20 to 25 per cent. more coal, required 50 per cent. more oil and cost 60 per cent. more for repairs than the English engines doing precisely the same work, and thereupon an apparently large proportion of the British public has jumped to the conclusion that the English locomotive has by this test been finally and conclusively proven to be far superior to the American locomotive, and that if American railway managers consulted the interests of their roads they would either import and use British locomotives here or build locomotives like them for use here, discarding the American type entirely. The editor of "The Mechanical Engineer" is, however, an exception and calls attention to the fact that this test is conclusive only as regards *these particular American engines and Midland traffic requirements.* Our contemporary does not of course attempt to show that American engines are the better machines, and does not believe that they are so; but its limitation of the application of the results of the test is manifestly correct and just what any experienced and at the same time unprejudiced engineer would insist upon.

In an article in "The Engineer" for June 14 Chas. Rous-Marten goes further into this phase of the question, and says:

"But the point which vitiates the whole comparison between these fine engines and the imported American engines, and equally vitiates all deductions from the result, is the indisputable fact that this type of American locomotive is not, with respect to its dimensions, one which would be used in America for the same duty, viz.: to haul trains weighing 500 tons British, or 560 tons American—1,120,000 pounds, as the Americans prefer to express it—at considerable speeds on roads with gradients of 1 in 200 to 1 in 100. For such duty in the United States locomotives of far greater power would be used than these which have only 1,214 to 1,364 square feet of heating surface, 160 pounds steam pressure, and cylinders 18x24 inches, with 5-foot coupled wheels. An American engineer would assuredly use a boiler with, at the least, 1,750 to 2,500 square feet of heating surface and 180 pounds steam pressure. Indeed, I believe that these very engines in question were built to use 180 pounds steam pressure, so that to work them at 160 pounds is an-

other handicap in their disfavor. Nor must the fact be overlooked that their piston stroke is shorter by 2 inches than that of their British competitors.

"It may reasonably be asked, 'Why, if the smaller dimensions suffice for the British engine, should they be insufficient for the American?' The reply is that all American locomotive practice is based upon the principle of allowing a margin of power. In all classes of work this is the rigid American rule, and, in pursuance of that rule, I assert, with considerable experience of American practice in various parts of the globe, that had the American builders been instructed to supply an engine to do certain specific duty, they would not have produced the type now seen on a few British railways, but one of far greater power. And therefore as the American locomotives have worked under conditions not suitable to their type, they necessarily have worked under a serious disadvantage. For when you try one locomotive which is specially designed on the spot for particular work against another built in a different country on a different design, and brought into the comparison merely as possessing approximately identical dimensions, you handicap the latter very adversely. Virtually you pit an engine, admittedly and specially suitable to its prescribed duty, against one which, while nominally of nearly equal power, is practically much less strong, because its type and design presuppose it to have a margin of strength which, under these conditions, is absent, and because also its type is only employed in its country of origin, for the specified work, with greatly larger dimensions.

"Therefore the recent Midland trial only proves that identical dimensions for identical work will not suit engines of totally different designs and modes of construction."

This, of course, does not mean that Mr. Rous-Marten is a partisan of the American locomotive, but only that he clearly sees through the sophistry being indulged in by many of his countrymen.

We should like to know also how much the results would have been changed had the American engines been handled by American engineers, accustomed to the American engines and determined to make them succeed; and especially we call attention to the fact that the cost of keeping locomotives in repair depends largely upon what appliances and methods are made use of in doing the work, and it is almost certain that the methods and means by which the work was done on the American locomotives were not such as would have been employed here, nor as effective as were used in repairing the British machines, for which the British shops are of course especially fitted up and equipped and supplied with men thoroughly accustomed to them. No machinist needs to be told that this would make a great difference in amount of repair bills.

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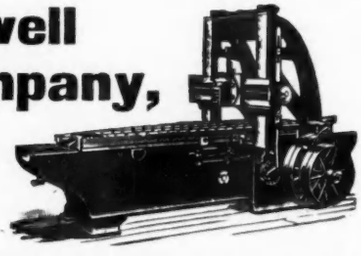

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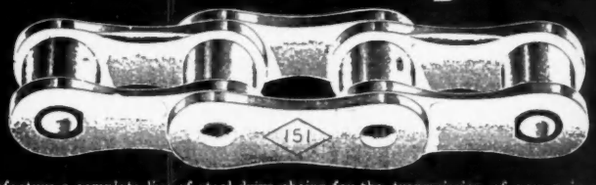

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